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THE ANT LION.

BY J. H. EMERTON.

Fig. 159.

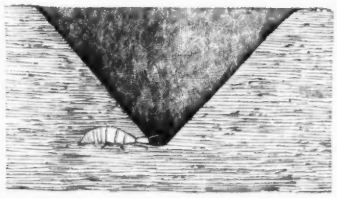
Ant Lion, adult.

On the twenty-ninth of August, while hunting spiders among the rocks on the hill north of Bartholomew's pond in South Danvers, Mass., I unexpectedly found the pit of an ant-lion (*Myrmeleo immaculatus* De Geer), in a clear space under the shade of a large boulder. The pit (Fig. 160) was about two inches in diameter and one deep. The insect himself was hid at the bottom, but when I dropped bits of earth into the hole he showed his position by throwing up sand. I then dug him out and took him home with me, where I put him into a bowl of dry, coarse sand, such as is used by masons for mortar. He remained buried for several days, but finally came to the surface, dug his pitfall, and gave me

an opportunity of observing his habits. Fig. 161 represents the ant-lion at this time, showing the under side with the feet in a natural position. At first he was so timid that as soon as any one approached he stopped where he was and remained motionless until left alone. If his pitfall was destroyed he dug a new one; but during all the time I kept him I never saw the whole process of digging it.

Fig. 161.

Fig. 160.



Ant-lion.

When taken out of the sand and laid on the surface he would keep quite still for a few moments, then retreat backward, by jerks, under the sand. He never moved forward but always backward by the contractions of his abdomen as much as by his feet, making a furrow through the sand. He seldom travelled an inch in one direction, and often made a complete circle in that distance. I think he commenced his pitfall by making a circle of this kind, and afterward throwing out the sand from the centre. In digging he used his flat head and jaws, which were pushed under several grains of sand and then jerked upward, throwing their load sometimes as far as six inches, and always far enough to avoid leaving a ridge around the pitfall. When the pit was finished he was entirely concealed beneath it, as in Fig. 160, except his jaws, which were spread apart horizontally at the bottom. The surface of the pit being as steep as the sand could be piled up was very easily disturbed, and when an insect ventured over the edge the ant-lion was apprised of it at once by the falling sand. He immediately began to throw up sand from the bottom, deepening the pit and so causing the sand to slip down from the sides and the insect

Fig. 162.

with it. The ant-lion seized it with his long jaws and held it up above his head until he had sucked all he wanted from it, when he threw the remainder out of the hole and repaired the trap. Fig. 162 (from Westwood), shows the structure of the jaws, and how the ant-lion may drink the juices from an insect without bringing it to his mouth. On the under side of each jaw (*a*), is a groove (*b*), extending from one end to the other, and partly filled by the slender maxilla which lies in it, forming a tube, one end of which passes into the insect which is bitten, while the other opens near the mouth of the ant-lion. After eating he became more timid, and sometimes would not take a second insect. If, however, several were put into the pit at once, he would bite one after the other until all were killed, before deciding on which to begin. I fed him two or three times a week, usually with house-flies, cutting their wings off and letting him take them in his own way. In October, having occasion to travel some distance, I put him in an ounce bottle half filled with sand, corked him up, and carried him with me in my bag. In about a week I gave him a large house-fly, which he did not catch, not having room enough in the bottle to make a pitfall. I gave him no more food till the next March. Meanwhile he remained for several months on a shelf in my room. Occasionally I tipped him out and always found him lively enough to right himself if turned on his back, and to retreat under the nearest sand. In January he was packed up in my trunk for more than a week, and when I opened it, after it had remained several days in a warm room, I found him as lively as when first caught. He afterwards became quite torpid again in a cold closet, where he remained through the rest of the winter. About the first of March, when flies began to be plenty, I commenced to feed him again. He found it rather awkward to catch insects in the bottle as there was not room enough to make a pitfall, and his inability to move forward made it hard for him to seize an insect unless he met it directly between his jaws.

He soon, however, made pitfalls half an inch in diameter, which answered the purpose. Sometimes he lay on the surface of the sand with a few grains scattered over his back to conceal him from notice, and his jaws extended on the surface. If a fly was put into the bottle it would circle around close to the glass and usually run over the ant-lion's back. He would jerk up his head and attempt to seize it, which he seldom succeeded in doing the first time. If he caught a leg or wing he was unable to move nearer and shorten his hold, and the fly escaped. He would often throw up the sand and try to undermine the fly. He would sometimes work an hour in these ways before the fly would get into a favorable position. I fed him every day or two until May 15th, when he spun a spherical cocoon (Fig. 161*a*) around him, and remained enclosed until June 25th, a very hot day, when he came partly out, and leaving his pupa skin half in the cocoon appeared as a perfect fly (Fig. 159), but did not spread his wings completely.

THE RESOURCES AND CLIMATE OF CALIFORNIA.

BY REV. A. P. PEABODY, D.D.

THE thought uppermost in my mind, during a recent visit to California, was of gratitude to the bravely patriotic men, who, in the late rebellion, at the risk of their own lives saved this great state for the Union.

One who has not been in California can hardly appreciate the magnitude of the threatened loss. The state might easily have maintained her independence, not only of her sister republics, but of all the world beside. It is potentially a self-sustaining empire. Exceeding in the aggregate of its territory the British Islands, it extends through all the degrees of latitude which are identified with a genial climate,

without stretching far enough northward to know the severity of winter, or far enough southward to feel the enervating influence of a tropical sun.

It could supply all its own wants. Its pastoral regions could easily furnish wool, hides and food for twenty times its present population. Its rivers and bays swarm with the choicest of fish, salmon being so abundant that it can hardly be accounted a luxury. The vine-bearing capacity of the one county of Sonoma exceeds that of all the wine-growing regions of Europe. Wheat has been harvested at the rate of ninety bushels to the acre, and fifty or sixty bushels are but an ordinary crop, twenty being regarded as a good yield in the Genesee district of New York. The fruits are unsurpassed in quality and in profusion, and are subject to none of the blights, parasitic insects and fungi, that infest our orchards, so that one need not fear to eat an apple in the dark. Strawberries may be bought in the San Francisco market every month in the year. It is not easy to name any fruit which will not ripen within the limits of the State. At Sonoma, on the grounds of General Vallejo, the old Spanish commandant of California, I saw ripe or ripening, along with all the common fruits of the temperate zone, oranges, lemons, bananas, olives, figs and almonds. I have eaten olives in Italy, but never any so good as those from the General's own trees on which I lunched at his table. In the southern part of the State, cotton is rapidly becoming a staple, and coffee, equal to the best St. Domingo, is already raised. The cultivation of tea has been commenced with the promise of complete success, and there is no reason why the spices of the East Indies should not become naturalized there.

There is also in the interior a supply of lumber of all kinds which it would take many centuries to exhaust, though as yet, for lack of available avenues for transportation, lumber for the cities on the coast is imported from Oregon. If every schooner, sloop and sail-boat in the world were a

ship of three thousand tons, I saw, on a single day's ride, enough pine trees from one to two hundred feet high, straight as an arrow, to furnish masts for all the vessels in the world, without perceptibly thinning the primeval forest.

The climate is unequalled in salubrity. In San Francisco a sea-breeze sets in from the ocean at three or four o'clock on a summer afternoon, rendering the air rather cooler than suits one not acclimated; but this is not experienced in the winter, and the average temperature of the winter is rather higher than that of the summer. Only a few miles from the coast the force of the ocean-breeze is spent. There the summer days are very hot, but the air is so pure that the thermometer of one's own consciousness is much below Fahrenheit's, and I found it as easy to take a long and brisk walk at the temperature of a hundred degrees, as it would be in New England at seventy-five. The night air is inexpressibly sweet and mild, so that one would not care whether he lodged within doors or under the star-gemmed roof. It is no uncommon thing to have the windows of lodging apartments taken out, and laid aside as useless, from the early spring till the autumn. The atmosphere, even in midsummer, is so entirely free from malaria, that lamb or veal hung up in the open air will dry before it becomes tainted; and outside of farmhouses and hotels we often see, suspended on trees, locked safes covered with wire-gauze, in which fresh meat may be preserved sound and sweet for several weeks.

For seven or eight months in the year rain never falls. The grass, indeed, looks brown; but the trees, which strike their roots down into soil still moist, retain their verdure, and for the various crops of grain and vegetables artificial irrigation is extensively employed, — windmills for raising water being used, not only on farms, but in orchards, and often in private gardens. The whole country is diversified by gentle elevations — foot-hills, as they are called — which generally furnish perennial fountains that are led among the valleys, unfailing sources of fertility and wealth. The cli-

mate facilitates the labor of harvest. The wheat and grain are threshed on their native field, bagged, and piled up against the fences till a convenient time for carrying them to market; and I often saw such huge piles of bagged wheat and oats, that it required some stretch of fancy to imagine that it could all have grown in a single year within the area of the field.

NOTES ON SOME BIRDS IN THE MUSEUM OF VASSAR COLLEGE.

BY PROFESSOR JAMES ORTON.

THE Ornithological Cabinet in the Vassar Museum, contains nearly twelve hundred distinct species, of which seven hundred are North American, and the remainder South American. Among them are several type specimens and others of historical interest as the originals of Audubon's celebrated drawings.

Falco islandicus Gm. This fine specimen formerly belonged to Audubon, to whom it was presented by Sir John Cheperstal, and is the original of the figure in "Birds of America."

Accipiter nigroplumbeus Lawr. TYPE. This new hawk was obtained by the writer in the Valley of Quito, where it is very rare.

Strix punctatissima Gray. Indigenous to the Galapagos, but now rather abundant in the Valley of Quito near the cotton-mills of Chillo, where it is called "Factory Owl." It lays nearly spherical eggs, in a rude nest made of a small quantity of rubbish scraped together and lined with a few feathers, and generally built in the gable ends of houses or under the eaves.

Trogon Mexicanus Sw. The late Mr. Giraud informed us that this specimen was shot in Texas. The Trogon fam-

ily is well represented in the East Indies; but it is more fully developed in the New World where there are about twenty-five species. In splendor of plumage they are surpassed only by the Hummers; in stupidity, by the Jacamars. Their only utterance sounds like *Te vio!* (I see thee). They are zygodactylous, but unlike the woodpeckers and parrots, the third or longest toe being the inward of the two forward toes instead of the outward.

Andigena laminirostris Gould. This rare bird represents a remarkable group of Toucans characterized by the dense villose clothing of the under surface. This species is found at Nanegal on the west slope of the Andes; not in the neighborhood of Quito, as stated by Mr. Gould. The Toucans, of which thirty-five species occur at the equator, are confined to tropical America. They live in dense forests in small companies. Their flight is laborious but not jerky. On the ground they hop like a robin. They have a shrill though variable cry, which sometimes has a vague resemblance to *tocáno*, and again to *pia-po-o-co*. The imaginative natives call them Preachers, because they seem to make the sign of the cross by wagging the head up, then to the left, next to the right, and finally down, saying at each movement *Dios tode* (God gave it you). The sexes are exactly alike. The most common species on the Upper Amazon are *Cuvieri*, *Humboldtii* and *pleuricinctus*.

Tetragonops ramphastinus Jard. This singular Barbet is called by the natives *venenero* or deer-hunter, because it whistles with ventriloqual powers. None of the Capitonidæ sing. The phlegmatic Buccos or "pig-birds," as the Indians call them, seem to have their head-quarters in Eastern Peru. The Tetragonops is a connecting link between the Barbets and Toucans.

Lesbia Ortoni Lawr. TYPE. This remarkably fine species is the latest addition to the Trochilidæ. It was discovered in the Valley of Quito at the foot of the isolated mountain Ilalo, and is the only specimen ever found. The

superstitious Indians who inhabit Ilalo are very exclusive, forbidding the approach of any white man to their mountain; and for this reason, probably, this Hummer has never before been seen. The collection contains one hundred and twenty-six species of Trochilidæ.

Chætura rutila Vieill. This elegant little Swift or "Nocturnal Swallow" was obtained in the Quito Valley, where it is very rare. Vieillot's type was found in Trinidad; Lafresnaye's specimens were from New Grenada; and Salvin procured them in Guatemala, where Sclater says it properly belongs. Its nest is not made of mud and sticks like that of its northern representative, our chimney swallow, but chiefly of moss, very compact and shallow, and located in dark culverts about two feet above the water; never on houses or trees.

Brachygalba lugubris Sw. RE-DISCOVERED TYPE. Since this Jacamar was first described in 1838, not a single specimen has come under the notice of any naturalist; and in 1853, Mr. Sclater declared that Swainson's bird remained to be re-discovered. This specimen was shot by Mr. Gilbert at Valencia in 1867, and has been recognized by the distinguished ornithologist, George N. Lawrence, Esq., as the lost *lugubris*. The only discrepancy from Swainson's description is the possession of four toes instead of three; but the hind toe is quite small. It is distinct from *B. inornata*. Jacamars stand next to the Trogons and Hummers in the beauty of their golden-bronze, and steel-colored plumage. They are peculiar to tropical America, and Guiana is their true home. None have been seen on the west slope of the Andes.

Todirostrum gracilipes Scl. The type in the British Museum came from Bogota; but this specimen was obtained by Hauxwell on the Upper Amazon. From the same locality we have the *Empidomus varius*.

Myiarchus Lawrencii Gir., *Basileuterus Belli* Gir., *B. Brasieri* Gir., *Dendroica olivacea* Gir., and *Cardellina rubrifrons* Gir. The types of these species formerly belonged

to this cabinet, but are now in the Smithsonian Institution, and are replaced by other specimens collected by Sumichrast, Salvin and Verreaux. To the day of his death, Mr. Giraud contended that the types were collected within the State of Texas.

Myiozetetes inornatus Lawr. TYPE. From Valencia, Venezuela.

Turdus Hauxwelli Lawr. TYPE. From Pebas, Peru.

Dendroica tigrina Gm. This handsome specimen was shot by Wilson in the vicinity of Cape May, 1812, and was described by him as a new species. Gmelin, however, in 1788 had named it *Motacilla tigrina*.

Euphonia elegantissima Bp. Our specimens do not conform to Sclater's description: the throat of the male is not "black," but bluish black like the back; the forehead is not "chestnut, margined behind with black," but is bright yellow.

E. nigricollis Vieill. This Tanager is one of the best songsters in the Valley of Quito; the other birds only twitter and chirp; like the people, too lazy to sing. The *Mimus lividus* is its rival in Brazil. The Tanagers generally have no melody of voice. They are restless, wary birds, having a rapid, abrupt flight, and seldom hopping on the ground. They are most numerous in New Granada, and the most important genus is *Calliste*. To the puzzling question, "What is a Tanager,?" Sclater answers, "a dentirostral Finch." At Quito the Finches build their nests in October.

Atticora fasciata Gm. This type of the genus is described by Baird as having ten tail feathers: both male and female in the Vassar collection show twelve. They are from the Maranon.

Pipra deliciosa Scl. One of the most brilliantly colored of the Manakins, the male being also remarkable for the singular structure of its wings, the secondaries being curved. By the natives it is called "Watchman," because it flies before certain blue birds, and makes a noise with its wings in case of danger.

Diglossa aterrima Lafr. The natives say that it changes its colors if taken to Pichincha, becoming like *D. Lafresnayi*.

Rupicola sanguinolenta Gould. This splendid "Cock of the Rock" is found only, we believe, on the western Andean slope. The *R. Peruviana* is confined to the eastern slope, and the *R. crocea* to the mountains of Guiana. It frequents shady ravines and is very shy. It "plays 'possum," falling apparently dead when shot at, but soon flies off. It makes a guttural noise not unlike the grunt of a hog. Like the Bird of Paradise, Peacock, Turkey, etc., the Cock of the Rock makes an extraordinary display of its finery just prior to the breeding season.

Chrysomitris Mexicana Bp. TYPE of *Fringilla Texensis* Gir.

Ocyalus latirostris Sw., *Clypicterus oseryi* and *Amblycersus solitarius*. These splendid specimens of Icteridæ were obtained on the Upper Amazon, where they appear to be rare.

Icterus Grace-annae Cass. This seems to be the only specimen found since its description. The type is in the Philadelphia Academy. This fixes the locality (Machala near Guayaquil), which was not positively known.

Cephalopterus ornatus Vieill. This Umbrella Bird came from the Upper Amazon. It was formerly thought to be confined to the islands in the Rio Negro. It is found only on the eastern side of the Andes; the *C. penduliger* being restricted to the western slope, and *C. glabricollis* to Central America. The throat lappet of *penduliger* is nearly ten inches long; that of *ornatus* about four, and of *glabricollis* insignificant. According to Fraser, the appendage seems generally held in a bunch like a rose under the throat, and to fall after death.

Chlorœnas vinacea and *Ortolida guttata;* from the Upper Amazon. Near Savonita on the west slope of the Andes is an Ortolida whose note sounds like *trabajá, trabajá* (work! work!), and the response of the answering bird is *mañana, manana* (to-morrow), a parody on Spanish character.

Meleagris ocellata Temm. A pair, male and female, in fine plumage.

Lophortyx Gambelii Nutt. Of this bird, "whose rarity is only equalled by its beauty" says Gould, there is a pair in perfect condition.

Demiegretta Pealii Bp., *Garzetta candidissima* Gm., *Florida cæruba* Linn., and *Ibis alba* Linn. These specimens once belonged to Audubon, from which he made the drawings for his large work.

Platalea ajaja Linn. This specimen was obtained of Dr. Trudeau. It was shot on the plantation of his father near Charleston, S. C.

Aphriza virgata Gm. TYPE of Audubon's *A. Townsendi*, from the mouth of Columbia River; the only specimen obtained within the bounds of the United States. Properly belongs to the Pacific Islands. Professor Baird doubts its occurrence on the shores of the northern Pacific, but Dr. Sclater does not. Several have been found on Vancouver's Island.

Phalaropus Wilsonii Sab. A superb specimen in Bell's best style of mounting.

Anser Gambelii Hart. Original of Audubon's drawing.

Bernicla leucopsis Linn. Original of Audubon's drawing.

Somateria spectabilis Linn. Specimen shot on Long Island Sound!

Sterna Trudeauii Aud. TYPE. The original of Audubon's figure and description; shot at Great Egg Harbor. According to Mr. Giraud, the only specimen found in North America. It is in full plumage.

Colymbus arcticus and *C. septentrionalis* Linn. Originals of Audubon's drawings.

Podiceps occipitalis Less. This grebe was found by the writer on Lake Mica, which is on the side of Antisana, Ecuador, 13,300 feet above the Pacific. It appears to be identical with the species abounding on the coast of Chili and Straits of Magellan. It is difficult to conceive how this

purely aquatic bird could or would ascend and cross the western Cordillera, and then ascend to an icy, solitary lake on the shoulder of one of the loftiest volcanoes in the eastern range, 2,500 miles from its native place. Forbes found *Cyclas Chilensis* (formerly considered peculiar to the most southern and coldest part of Chili at the level of the sea) abundant in fresh-water ponds in the Bolivian plateau near La Paz, 14,000 feet high. Do not these facts point to changes in the Andes on a grand scale, and at a rate which, measured by the time required for a change of species, must be termed rapid ?

Alca impennis Linn. Original of Audubon's figure. A notice of this specimen was published in the *American Naturalist*, 1869.

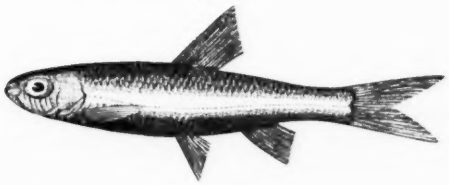
Mormon cirrhata Pall. Original of Audubon's figure.

Phaleris cristatella Pall. Original of Audubon's figure.

FURTHER NOTES ON NEW JERSEY FISHES.

BY CHARLES C. ABBOTT, M.D.

Fig. 163.



Hybognathus.

During the month of February of the present year (1870), Professor George H. Cook, State Geologist, sent to the author of this paper a number of "frost-fish," or "smelt" (*Osmerus mordax*), and among them was the single specimen figured above. On submitting this cyprinoid to Pro-

fessor Cope of Philadelphia, he pronounced it undescribed, and has since described it* as *Hybognathus osmerinus*.

During the past summer the author had no opportunity of fishing in the Raritan River, at or about New Brunswick, at which point the specimen was taken; but among a number of small collections from that river, no specimen of this cyprinoid occurred. From other streams, generally not in the basin of the Raritan, isolated specimens have occurred, and the distribution seems to be without reference to salt water, although the type, and two other specimens, were taken from streams having direct access to the sea.

Of its habits, as yet, we have determined nothing; only learning from the specimens we have seen, that it seems to be very scarce, and associated by twos and threes with other cyprinoids, more especially with *Hybopsis Hudsonius*, which is very abundant in many of our smaller streams, as well as the Delaware River.

During the month of August of this year, the writer found a locality for two species which are not abundant elsewhere, so far as his own observations go to show. These fish are an etheostomoid (*Hololepis erochrous* Cope), and a "cat-fish" (*Noturus gyrinus*). They were both found abundantly in Stony Brook, Mercer Co., N. J., near the village of Princeton. The stream here is shallow, with a muddy bottom, and here and there a flat stone or two, under which both species took refuge when disturbed. On approaching the brook, the fish were found to be lying on the mud, near the edge of the stream, in water scarcely two inches deep. The movements of the etheostomoids were very deliberate, as they usually moved very slowly, making straight lines on the mud, apparently by not lifting themselves from the bottom of the stream. By placing a small baited hook immediately in front of the "darters," they would seize it with all the rapidity and voraciousness of a pike, and upon swallowing it,

* A Partial Synopsis of the Fishes of the Fresh Waters of North Carolina. By Edward D. Cope, A.M. Amer. Phil. Soc., Phila., 1870, p. 466; *foot note*.

would invariably be taken. The writer took nearly fifty specimens with a hook, in about two hours. The "stone-cat-fish" were much more active, and shy; and would not take the hook, until after an immense deal of nibbling trying to the patience.

While collecting specimens in Stony Brook, as mentioned above, the writer met with a nearly exhausted eel, into the left gills of which, a lamprey (*Petromyzon nigricans*), had inserted its sucking apparatus. The eel had drawn the lamprey by the suction power of the gill, into its throat, and having thus killed the lamprey, was itself nearly dead from endeavors to get rid of so great an incumbrance. In the stomachs of both the eel and the lamprey, were found masses of partially broken shells of minute *Lymneæ*, showing (circumstantial evidence) that they had been occupied in feeding upon the same food on the same ground, when the lamprey made his unfortunate attack upon the eel. Has it been noticed before, that the lamprey feeds upon small shells?

Two specimens of *Aphrodederus Sayanus*, were taken in Stony Brook, during the summer, and have been since kept alive in an aquarium. Soon after their capture, and since, one of them has exhibited the following "freak of coloration." The specimens, while lying on the pebbles at the bottom of the tank, were each of a glossy black, relieved by a pale brown throat, well dotted with black; and with a snowy white margin to the caudal fin. They were removed by a small net, to another tank having somewhat colder water in it, and immediately one of the pair became of a uniform pale straw color, except the black dots on the throat, and a narrow line running from the lower edge of the orbit to the jaw. The white margin of the caudal fin was scarcely distinguishable from the general color of the fin and body. The iris became silvery, with a mere trace of yellow. In the course of half an hour, the tints commenced to grow deeper, and full two hours elapsed before the usual black hue was resumed and the two specimens became similar in appearance.

Had this specimen thus "bleached" on being removed from one tank to another, done so on being taken wholly from the water, and, thus faded, had been preserved in alcohol, might it not have been looked upon as an *Aphrodederus albidus* nov. spec., and thus additional synonomy been offered to the confusion now existing? Is it, in fact, safe to consider color as of *any value* as a specific character, unless by comparing many specimens, and finding the variation uniform and without gradations? We have found the "sun-fish" as a group, to vary very much in accordance with the character of the stream in which they were found; and in an aquarium the "banded sunfish" (*Mesogonistius chætodon* Gill), is verily kaleidoscopic. The black bands actually sometimes *wholly* disappear!

THE SPORES OF LICHENS.

BY H. WILLEY.

The importance of the spores in the study of lichens, will perhaps render interesting a more extended reference to this branch of lichen history. The spores were known to Micheli, who figures those of several species in his "Nova Genera Plantarum," 1729, as did also Acharius in his "Lichenographia Universalis," 1810. But he made no use of them in his system. The great work of Fries, "Lichenographia Europæa Reformata," 1831, has no reference to the spores, excepting a few remarks in regard to their germination; but Eschweiler in the same year, made a somewhat careful examination of them, and noticed their various forms, although he endeavored in vain, he says, to make use of the spore-case in distinguishing genera. Fée, in the supplement to his "Essai," 1837, was the first to do this, and to figure and describe accurately the spore-cases and spores. But

De Notaris in 1846, from which period Krempelhuber dates the modern period of Lichenology, fully inaugurated the new method, and established it on a solid foundation. He pointed out the unity of the spore-type in many natural genera, and declared that species in which the spores presented important differences could not be grouped together. But the results of his labors do not appear to have been combined into a general system. Norman, in Norway, 1852, Massalongo, in Italy, 1852, and Koerber in Germany, 1854–1859, continued his work, and based their systems to a greater or less degree, on spore characters, while the younger Fries, Trevisan, Stitzenberger and others have labored successfully in the same field, and made important contributions to this department. No description of a lichen is now considered adequate which does not give an account of the spores, when they are to be found.

The Italian school, however, has attributed too great importance to minor distinctions in the size of spores, their septation, and number in the spore-case, attaching great importance to micrometric measurements, and thereby increasing the species and genera to a most unwarrantable degree, and not unfrequently violating natural affinities, answering no useful end and tending rather to create confusion than to advance true science. A few instances may serve to illustrate this. *Pyrenula nitida* Schær. is a very common bark lichen, and subject to but slight variation. The average length of the spores is from .018 to .022 millimetre; but specimens occur, which cannot be separated from it, in which they measure constantly from .030 to .038. *Arthonia velata* Nyl. is another instance in which the spores in some specimens are constantly nearly twice as large as in others. The spores of *Sagedia chlorotica* Ach. are described in the European forms as constantly 4-blastish, measuring from .018 to .023. Here they are usually from 4 to 6-blastish, and measure from .025 to .047, and it is only recently that I have found specimens with constantly 4-blastish spores, a

little smaller than the European, and measuring from .014 to .020. *Sagedia cestrencis* Tuck. is another example, though I am doubtful whether my specimens are different from *S. carpinea* Pers. As it occurs on the beech, the spores are fusiform, and measure from .034 to .038, while those on the hemlock, referred to the same species, are acicular and from .072 to .118. But perhaps the difference in form would justify making this a distinct species. *Rinodina sophodes* Mass. and *Biatora rubella* Fr. are two very variable species, but specimens referred to each vary in the former from .010 to .025, and in the latter from .018 to .075.

So in regard to the number of spores in the spore-case. The form of *Rinodina sophodes* in which the spore-cases contain twelve or more spores, can hardly be distinguished from that in which there are only eight, though Th. Fries makes it a separate species, under the name *R. polyspora*. I have found specimens of *Buellia microcarpa* D. C. which do not differ from the common form more than the two forms of *R. sophodes*, but in which there are from eight to sixteen spores in a spore-case; and a parasitic lichen on the thallus of a Saxicoline *Pertusaria* which appears to differ from *Buellia parasitica* Flk., only in the spore-cases containing a large number of spores. These examples might be numerously increased, but they are perhaps sufficient to show that too much importance should not be attached to what Professor Tuckerman calls "mere *gradal* differences."

Nylander, the great French lichenist and the antagonist of the German-Italian school, does not seem to attach sufficient importance to the differences in spore characters. In his remarks in his "Synopsis" on specific characters in lichens, he contents himself with a few indefinite observations in regard to them, and in his classification makes no generic distinctions based on form or color. Thus Rinodina is included under Lecanora, and Buellia under Lecidea. Indeed he seems to consider the spermatia as more important classificatory organs than the spores. In his descriptions, however,

he gives the forms of the spores, though not always accurately, and their measurements. While the Italian and German writers on the one hand tend to too great a subdivision of genera and species, Nylander, on the other, is frequently too comprehensive, though this is perhaps the safer error of the two.

Professor Tuckerman of Amherst, has expressed briefly his views on the value of spore characters, in his "Lichens of California," 1866, and has laid the foundation of a more sound and instructive doctrine on this subject than previous writers. In his opinion, which has been followed in what precedes, "less weight than has often been assumed should be given to spore differences of a merely gradal character, or such others as depend only on mensuration, and more to those that seem typical." He considers that there are "two well defined kinds of lichen-spores, complemented in the highest tribe only by a well-defined intermediate one. In one of these (typically colorless) the originally simple spore, passing through a series of modifications, always in one direction, and tending constantly to elongation, affords at length *the acicular type*. To this is opposed (most frequently but not exclusively in the lower tribes, and even possibly anticipated by *the polar-bilocular sub-type* in *Parmeliacei*), a second (typically colored) in which the simple spore, completing another series of changes, tending rather to distension and to division in one direction, exhibits finally *the muriform type*." In accordance with this view Rinodina is distinguished from Lecanora, and Buellia from Lecidea. *Theloschistes parietinus* is separated from Physcia, a genus with colored spores, and placed in a distinct genus, the type of whose spore is the *polar-bilocular*. On the other hand *Biatora rubella* would not be separated from that genus, which includes species with simple spores, merely on account of its septate spores, nor *Buellia petræa* placed in a distinct genus, Rhizocarpon, on account of its muriform spores, nor *Lecanora cervina* on account of its polysporous

spore-cases. It is to be observed, however, that the typically colored spore is often, as Professor Tuckerman expresses it, decolorate. Thus the spores of *Buellia petræa*, are often, and always, so far as I have observed, in a form which occurs on rails, colorless, and frequently only 2-blastish. Similar conditions also occur of *Rinodina sophodes* and *R. ascociscana*. *Pertusaria* is another genus in which the spores should probably be considered as typically colored. They are usually of a yellowish tinge, and in one specimen of *P. leioplaca* they were of a rich golden brown. There are many genera in which species with spores belonging to the typically colored series, have spores always, so far as observed, colorless, or "decolorate." In the genera of all the great families of lichens will be found spores corresponding to these various types; and a table might be constructed, showing the analogies throughout. But into the subject of lichen classification it is not my purpose here to enter.

Our illustrations in the preceding number of the NATURALIST show the different types of spores as thus distinguished; those of *T. parietina* being polar-bilocular, those of *Biatora rubella*, acicular, and those of *Buellia petræa*, muriform. The adoption of this idea will certainly introduce an order and clearness into lichenology which it has hitherto lacked, and will do away with a host of genera of the German and Italian writers, which serve only to encumber the books and to embarrass and confuse the student. There are perhaps some exceptions, as Professor Tuckerman admits, in regard to Gyalecta, and as is perhaps the case also with Arthonia. But these may disappear with further knowledge, and we have to thank the Professor for an idea which greatly simplifies a difficult study, and whose advantages, as he justly remarks, far outweigh its difficulties. He has promised a further discussion of the subject in his forthcoming work on the Genera of North American Lichens.

THE SPERM WHALES, GIANT AND PYGMY.

BY THEODORE GILL, M.D., PH.D.

Vastness of size is so generally, and it may almost be conceded, so naturally associated in the popular idea with the whales, that some may scarcely be able to realize at first the fact that there are species no larger than ordinary porpoises; and yet which agree so closely in all the more essential elements of structure with some of the whales, that it is impossible, in a natural system, to separate them far from their gigantic relatives. We say *some* of the whales, for it is to be observed that the animals which are designated popularly as whales do not form a natural group, as contradistinguished from other animals. As popularly applied, the word whale is a designation used in common for all the gigantic cetaceans, whether they be toothless and furnished with whalebone, as are the right-whales, or whether they be toothed, as are the sperm-whales, or cachalots.*

The pygmies, to which we have alluded above, would not answer, then, to the popular conception. But, indeed, there are no characters which are coördinated with size, and which would enable one to give a definition other than relative to size. We have to enter upon a more profound examination before being able to ascertain the relations of the various members of the cetacean order. It is only by taking into account the sum total of characters, internal as well as external, that we are at length enabled to arrive at a correct appreciation of the true affinities of animals, and this inductive mode of study, applied to the cetaceans, teaches us that

* It should be added, however, that "whale" seems to be used by some whalemen as a quasi-generic term for the cetaceans (see Cheever, "The Whale and his Captors," pp. 96, 97), and is also applied by other persons to some of the larger *Delphinidæ*, such as *Beluga* (the white whale), *Orca* (the killer whale), *Globiocephalus* (the caing whale), etc.

in the order are two great groups, which, we may at once add, are suborders; and that these groups are distinguished from each other by numerous characteristics: the most apparent of these are, in one group, (the MYSTICETE,) the development of whalebone on the roof of the mouth, and the entire want of teeth,* — they being reabsorbed into the gums before birth,—the development of an olfactory organ, and of nasal bones free at their distal ends; and in the other group, (the DENTICETI,) the absence of the whalebone, and the development of teeth after birth generally persistent in one or both jaws during life, but in some forms more or less early deciduous; the olfactory organ is atrophied, and the nasal bones are appressed to the frontals and overlapped by the vomer.

It is not in one alone of these groups that we find associated together, in a natural morphological combination, giants and dwarfs, although only in one do we find the contrast in the present age of our globe. It is the family of *Physeteridæ* (the sperm-whales) which furnishes us with the contrast in living forms; only giants are now living to represent the *Balænidæ* (the right-whales), and *Balænopteridæ* (the fin-back whales), but in the miocene age, a species of a fin-back whale lived that when adult was not even as large as the *new born young* of the fin-backs now living.† It is, however, only with the pygmy sperm-whales, equally small or even smaller, compared with their gigantic relatives,‡ that we will now concern ourselves. And we will commence our study with the enquiry as to what are the essential characters of the family to which they belong. Our task is ren-

*Teeth are present, however, in the fœtus, but are not functionally developed.

†See Cope in Proceedings of the Academy of Natural Sciences of Philadelphia.

‡Beale, a trustworthy observer, has recorded the capture in the "Japan Fishery" of a male cachalot eighty-four feet long; J. D. Bennett has remarked "that the largest size authentically recorded of the sperm-whale is seventy-six feet in length, by thirty-eight in girth; but whalers are well contented to consider sixty feet the average of the largest examples they commonly obtain." Professor Flower, after a critical study, concluded that the length might be about sixty feet, and "ventures to question whether the cachalot frequently, if ever, exceeds that length, *when measured in a straight line.*" The adult *Kogiinæ* attain a length of from seven to eleven feet.

dered easy by the recent publication of a very elaborate monograph "On the Osteology of the Cachalot or Sperm-whale (*Physeter macrocephalus*)," by Professor Flower of the Royal College of Surgeons of England, and a full description and illustrations of a pygmy whale, by Professor Owen, who has been the first to clearly elucidate the details of structure of a member of the group of small species.

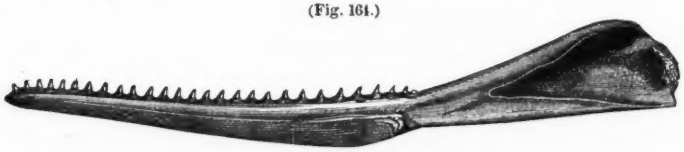
1. *Families of Toothed Cetaceans.* There are four families of toothed cetaceans: the *Physeterids*, or sperm-whales; the *Ziphiids*, nearly allied to the former, but in some respects approaching nearer to the *Delphinids*; the *Platanistids*, containing mostly fresh-water forms; and, finally, the *Delphinids*, containing by far the largest number of genera and species, and embracing the dolphins (not the fishes of that name), the porpoises, etc. It is on a comparison between the members of all those families that the following characters are shown to be peculiar, either absolutely or in combination, to the Physeteridæ.

2. *Common Character of Sperm-whales.* The form is variable, the head being either disproportionately large and blunt in front, with a subterminal blower, as in the giant whales, or conical, as in the dwarfs; the snout, however, always projects forwards, and the mouth is inferior. The cervical vertebræ in whole, or the atlas excepted, are anchylosed together. The hinder ribs lose their heads, and are only connected by their tubercles with the transverse processes of the vertebræ. The costal cartilages which connect the ribs with the sternum retain more or less of their original cartilaginous condition. The skull has the bones raised so as to form a more or less elevated retrorsely convex crest behind the anterior nares. The supraoccipital (*so*) and parietals combined extend forwards on the sides, and present a convex border projecting forwards high above the temporal fossa, and forwards beyond the vertex. The frontal (*f*) bones have an extended lateral surface deflected downwards and produced upwards, exposing to view

a triangular or *retrorsely* falciform wedge between the maxillaries and supraoccipital. The left nasal bone (*n*) is atrophied; the right hypertrophied and twisted to the left side. The jugal (*j*) is well developed and projects downwards or backwards. The orbit is small or of moderate size. The pterygoid (*pt*) bones are thick, produced forwards and entering largely into the bony roof of the mouth over and behind the palatine (*pal*) bones, not contiguous at the middle, with low ridges on the oral surface diverging more or less backwards and outwards, and with sides not involuted so as to form the outer wall of the postpalatine air-sinus. The lower jaw has a more or less elongated symphysis. Teeth are functionally developed only or chiefly in the lower jaw. The pectoral limb is small.

3. *Deductions.* Such are the characters possessed by all the members of the family. It will be observed that all but

(Fig. 161.)



Lower Jaw of *Physeter macrocephalus*, from Flower.

one of them which are truly distinctive are derived from the internal organization, and as some persons may complain of this and ask why external characters have not been employed, it may be added that there *are no* distinctive external features, except the inferiority of the mouth, and that only owes its importance to its coördination with others. It cannot be too often repeated that our judgment respecting the relations of animals is only reliable when based on the most complete and comprehensive examination of the entire structure, external as well as internal, and that one of the first elements of a natural classification is that the characters used shall be at least expressive of the sum of all the common characters.

In order now to exhibit the relative importance of the characters and their subordination, it may simply be stated that the chief, or at least most salient peculiarities in the form and relation of the bones are those exhibited by the supraoccipital in combination with the parietals, and also those presented by the frontals. In these respects, the sperm-whales stand alone among the cetaceans, while the Ziphiids, to which they are most nearly allied, and with which they agree in the costal cartilages, the form of the pterygoids, etc., resemble the Delphinids in the development of those bones.

4. *Differences among Physeterids.* Having now pretty carefully passed in review the common characters of the Physeterids, we may now enter on an examination of the subdivisions which are indicated by a similar course of study. After a detailed investigation of all known forms it is found that they may readily be grouped into two divisions which are separated from each other by many striking peculiarities. One of these is represented by the large species; the other by small ones; for the former, has been retained by the best naturalists the Linnæan name *Physeter;* for the latter, was first proposed the Grayan name *Kogia*, a barbarous designation which has by some been superseded by *Euphysetes*. In order to exhibit at once the contrast between the two forms, and to facilitate comparison, we append the characters in parallel columns.

PHYSETER.	KOGIA.
Form massive, with the head very large, oblong in profile and truncated at the front; eyes very small, very low, and near the angle of the mouth; blow-hole anterior, and at or near the edge of the truncated snout.	Form delphinoid, with the head conical, the snout being attenuated and projecting beyond the mouth; eyes moderate, nearer the forehead than the angle of the mouth; blow-hole at the forehead.
Dorsal fin represented by a hump.	Dorsal fin falcate.
Cervical vertebræ differentiated into an atlas and a combination of the second to seventh anchylosed and fused together.	Cervical vertebræ all united by anchylosis.

Ribs about ten or eleven pairs in number.	Ribs about thirteen or fourteen pairs in number.
Skull abruptly contracted into the attenuated rostrum, which equals or exceeds three times the length of the condylo-orbital line; above, semi-circular behind; with the rostral part oblong and acute conic.	Skull gradually sloping into the rostrum, which is shorter than the condylo-orbital line; above, reniform behind; with the rostrum obtusely conic.
Cerebral cavity declining downwards.	Cerebral cavity inclining upwards.
Occipito-sphenoid axis angular; the basioccipital portion very declivous or almost perpendicular, and the anterior part of sphenoid portion inclining upwards.	Occipito-sphenoid axis continuous upwards from the thickened horizontal floor in front of the foramen magnum.
Basisphenoid (*bs*) and palatines (*pal*) not or scarcely visible from the side, being concealed from view by the exoccipitals and squamosals.	Basisphenoid and palatines curved downwards and outwards, and largely exposed to view from the sides.
Frontal (*f*) with the exposed surface broadly triangular above between the supraoccipital and maxillaries; curved inwards behind the postorbital process; the process is very distinct.	Frontal with the exposed surface retrorsely curved above; with an angulated margin above the temporal cavity.
Squamosal (*s*) with an external oblong triangular surface, and with a zygomatic process for articulation with the jugal; contributing little surface to the floor of the temporal fossa.	Squamosal with a small, external surface, but a large incurved surface, forming the largest portion of the periphery of the temporal fossa.
Jugals (*j*) inclined backwards, and articulated with zygomatic processes of the squamosals.	Jugals inclined downwards and remote from the squamosals.
Nasal (*n*) bone flat, smooth.	Nasal bone with a thickened sigmoidally sinuous ridge continued from the nasal septum to the vertex, and with a less defined branch extending from its posterior part forwards on the right intermaxillary.

Maxillaries (*m*) continuous, the contour being simply interrupted by the anteorbital notch; the anterior portion very long, high, wide, and carinate at its proximal half; the posterior portion simply declivous on the frontals.	Maxillaries differentiated into two portions by the deep anteorbital notch; the anterior short, low, narrow, and ecarinate; the posterior portion with a thickened external contour.
Intermaxillaries (*i*) very elongate, nearly contiguous anteriorly, and projecting forwards considerably beyond the maxillaries.	Intermaxillaries very short, diverging forwards on account of the development of the vomer; not or little extending beyond the maxillaries.
Lower jaw with the symphysis nearly co-equal with the alveolar region, and more than half the length of the rami.*	Lower jaw with the symphysis little more than half as long as the alveolar region, and less than a third the length of the rami.

5. *Deductions Respecting the Relative Value of Differences.* Thus have we in considerable detail contrasted the respective peculiarities of the two groups of Physeterids. We have gone into such detail, as it is only in that way that we can appreciate the great difference between the two. The question now arises, what is the value of those groups? Are they simply genera? or are they entitled to higher rank?

On account of the limited number of species, and the close relationship of the several members of the respective groups, we are compelled to judge somewhat by analogy, and comparison with allied families. As the result of such comparisons, especially among the representatives of the families *Ziphiids* and *Delphinids*, it is believed that the value of several characters above given is of more than generic value, the difference appearing to be very much greater than exists between genera in either of those families, and it is there-

*Our readers residing in Boston and its suburbs can verify the characters of *Physeter* by a visit to the Museum of Comparative Zoology, at Cambridge, belonging to which establishment are the skull and parts of the skeleton of an individual obtained, we believe, on the coast of New Jersey.

It may be remarked here that some fossil remains from the Miocene of the Eastern United States have been referred to the *Physeteridæ*, with the names *Orycterocetus cornutidens* Leidy, *O. crocodilinus* Cope, and *Ontocetus Emmonsii* Leidy; and some from the Pliocene, as *Physeter antiquus* Leidy.

fore proposed to designate the genera *Physeter* and *Kogia* as representatives of two sub-families of PHYSETERIDÆ, to be respectively designated as PHYSETERINÆ and KOGIINÆ. If we are called upon to make a distinction between subfamily and generic characters, it is believed that the most important are the form of the head (a difference of greater moment than analagous ones among the Delphinidæ) and position of the blow-holes, the form and direction of the cerebral cavity and coördinate modification of its enclosing bones; the direction of the occipito-sphenoid axis, and the form and relations of the jugal and zygomatic processes of the squamosal bones.

And lest some may entertain a suspicion that some of the differences above enumerated may be the result of vegetative growth (or bulk) in *Physeter*, it is proper to add that the young of that form essentially resembles the adult, and that the characters enumerated are as applicable to the one as to the other. Nor are the characteristics of *Kogia* the expressions of arrested development; they are special modifications, and the form itself is quite as specialized a type as is *Physeter* itself. Both forms, so far as known, have equally lost the evidences of the nature of their common progenitor, and it is impossible to decide, from present facts, which is the most divergent from the common stock. If we were to be guided by consideration of size, *Kogia* would seem to be the most divergent, the typical *Physeterids* and related *Ziphiids* being all large animals, but such hint would probably be illusive *per se*, although really perhaps near the truth.

6. *Subdivisions of the Family.* While the first subdivision of the family into two subfamilies based on tangible and reliable data, is that presented in this article, a binary division had been previously proposed by Dr. J. E. Gray, in the "Additions and Corrections" of his "Catalogue of Seals and Whales in the British Museum," published in 1866; therein (p. 386), he subdivides the family as follows:

I. *Head compressed, truncated in front. Blowers in front of the upper part of the head. Skull elongate. Dorsal hump rounded. Pectoral fin short, truncated.* Catodontina.

1. CATODON. The atlas oblong, transverse, nearly twice as broad as high; the central canal subtrigonal, narrow below.

2. MEGANEURON. The atlas subcircular, rather broader than high; the central canal circular, in the middle of the body, widened above.

II. *Head depressed, rounded in front. Blowers at the back of the forehead. Mouth small, inferior. Dorsal fin compressed, falcate. Pectoral elongate, falcate.* Physeterina.

3. PHYSETER. Head large, elongate, rather depressed in front.

4. KOGIA. Head moderate, blunt and high in front. Skull short and broad. The septum that divides the crown of the skull very sinuous, folded so as to form a funnel-shaped concavity.

5. EUPHYSETES. Head moderate, blunt and high in front. Skull short and broad. The septum that divides the crown of the skull simple, longitudinal, only slightly curved."

No animal has ever been seen in recent times in which the alleged characters of frontal blow-hole and falciform dorsal have been found associated with the structural characters and size of *Physeter*, and as Dr. Gray himself remarks, "there is not a bone, nor even a fragment of a bone, nor any part that can be proved to have belonged to a specimen of this gigantic animal, to be seen in any museum in Europe." Commenting on this, Flower adds that "if the Linnæan genus *Physeter* is to be kept in abeyance until the discovery of Sibbald's *Balæna macrocephala tripinna* [the only basis for the so-called *Physeter tursio*], it is to be feared that it may ultimately disappear altogether from zoological literature." Heartily concurring in this view, and coinciding with the most judicious cetologists that the Sibbaldian animal was simply distinguished on account of a misapprehension as to its relations, and that it was, as Eschricht has observed,* an old cachalot with worn teeth, the name *Physeter* is retained for it as that proposed by the founder of zoological taxonomy. In this case the name *Physeterinæ* of course must be connected with the same form. The factitious genus

*Dr. Gray has, from some misunderstanding, remarked that "Eschricht seems to believe that Sibbald described a Killer or *Orca gladiator*, under the above name."

Physeter being eliminated, none but the small sperm-whales are left in the Grayan tribe *Physeterina*, and they form a natural group for which the name *Kogiinæ* has been above proposed; while the apparently most essential characters have been first attributed to it.

The genera *Catodon* and *Meganeuron*, distinguished, so far as known, solely by differences in the osseous development of the cervical vertebræ, may better be conjoined provisionally under the single generic name *Physeter*.

The diagnoses of *Kogia* and *Euphysetes* do not appear to be the expressions of actual differences.

7. *The Species of Physeterins.* The sperm whales, or Cachalots, according to Flower, "unlike the right-whales, are

Fig. 165.*

Physeter.

essentially inhabitants of the tropical and warmer parts of the temperate seas, and pass freely from one hemisphere into another." They have been observed in every sea, wandering northward in the Pacific to the Straits of Bering; in the Atlantic, straggling northward, at least as far as the coasts of Britain and the North Sea; and in the southern hemisphere, they have been found rounding the capes, and passing from one ocean to the other. "Between the North Atlantic and the Australian seas there is no barrier interposed to animals of such great powers of locomotion."

Fig. 166.†

*Fig. 165. Outline of the Cachalot, copied from Beale's "Natural History of the Sperm-whale," 1839, p. 23; *b*, the situation of the case; *c*, the junk; *d*, the bunch of the neck; *h*, the hump; *i*, the ridge; *k*, the small; *f*, the tail or flukes. Between the oblique dotted lines are the spiral strips, or blanket pieces; the area.

†Fig. 166. Head seen from the front; the lines forming the square are intended to represent the flat anterior part of the head.

As may be supposed, animals from places so widely distant have furnished the bases for different specific names, and after various fluctuations of opinion, in the last general com pleted work on the cetaceans—that by Dr. Gray already referred to—three authenticated and four doubtful species of true Physeterinæ are admitted, exclusive of the nominal *Physeter tursio*. The three considered established by him are *Catodon macrocephalus*, *Catodon australis*, and *Meganeuron Krefftii;* the four "species wanting further confirmation" are the Pacific sperm-whale (*Catodon Colneti* Gray), the South African sperm-whale (*Catodon macrocephalus* A. Smith), the Indian sperm-whale (*Catodon macrocephalus* Blyth), and the South Sea sperm-whale (*Physeter polycyphus* Quoy and Gaimard).

Professor Flower, after an elaborate comparison of skeletons of *Physeter* from the British waters and from the Tasmanian seas (the home of *P. australis*), arrived at the conclusion that the apparent differences of *P. australis*, compared with *P. macrocephalus*, were the characters of immaturity or the result of error in the identification of parts, and "putting aside these distinctive characters as valueless, there is not one other presenting any approach to a specific distinction pointed out throughout the whole memoir by Wall," and he himself has been unable to find any specific differences between the Northern Atlantic and Southern Pacific forms; he, however, is careful to remark that he does not "deny the possibility of their being specifically distinct," and very appropriately adds that "similarity of osteological characters does not prove unity of species." But until such can be defined, specific names would only mislead.

As to the "species wanting farther confirmation," it is sufficient that Dr. Gray ranks them in that category.

One other name only needs notice, the *Meganeuron Krefftii* Gray, founded on cervical vertebræ; the atlas certainly differs considerably from those of the *Physeter macrocephalus* hitherto made known. Mr. Krefft, however, who

transmitted them to Dr. Gray, finally regarded the "mass of vertebræ as belonging to *Catodon australis*." Until the acquirement of further data, the relations of the form will be doubtful.

8. *The Species of Kogiins.* Representatives of the subfamily have been obtained at the Cape of Good Hope, near Sidney (Australia), and from the coast of the Madras Presidency, and respectively attributed to four species. To the localities already distinguished, we may now add Lower California, from which the lower jaw of a specimen, as well as a figure and notice of the animal, have recently been forwarded by Colonel Grayson. It would therefore appear probable that the group is quite generally distributed in the

Fig. 167.

Kogia Flowerí, adapted from a colored figure by Col. Grayson.

Pacific Ocean, and probably in the South Atlantic. The four forms previously distinguished as species have been referred by Dr. Gray, as already indicated, to two genera, *Kogia* and *Euphysetes;* the latter name having been restricted to the form on which it was primitively based, while the three others have been referred to *Kogia*. As above remarked, the pertinence of the new diagnosis of *Euphysetes* to its type is not apparent, and is at variance with the original description as well as figure of the species. Of the species mentioned, the Indian form is by far the best known, thanks to Sir Walter Elliot, the collector, and Professor Owen, the describer; two Australian forms have been specifically distinguished by Mr. Krefft, after an examination of the skeletons of both; the species of the Cape of Good Hope is only known from a skull, and the Californian species

only from the lower jaw and the accompanying figure; but those combined will be sufficient to readily distinguish the last species from its congeners, although we must await with impatience the collection of better material, and we may be allowed to hope that this article may incite our Californian friends to seek for and procure specimens.

Our present knowledge of the species of this sub-family seems to indicate that there are two well-marked divisions, one of which is represented by the species (*Physeter breviceps* Bl.), on which the genus *Kogia* was originally based by Dr. Gray, and to which the *Euphysetes Grayi* Wall, the *Euphysetes Macleayi* Krefft, and the Mazatlan individual also belong; and the other division is represented by the *Euphysetes simus* Owen. These are very decidedly distinguished by the difference in the form of the lower jaw, and the form as well as development of the teeth.

In all the typical Kogiæ, the lower jaw, for each ramus, has a more or less truncated oar-shaped posterior margin, and from its upper and lower angles, the respective margins converge, describing nearly straight or little convex outlines, to the alveolar area, the lower margin ascending upwards to the symphysis, where the rami are parallel or nearly so, and which there project downwards into a longitudinally convex carina. There are from thirteen to fifteen teeth in each ramus; they are very long, much curved, and acutely pointed.

In *Euphysetes simus* "each ramus has a convex, almost semicircular posterior margin, curving upward and backward from below where the angle normally exists in other mammals, and then forward to the seat of the coronoid process [etc.]. In the alveolar groove are partially excavated sockets for nine teeth [etc.]; the teeth are small, straight, conical, obtuse, not exceeding eight lines in length, of which the cylindrical base has a diameter of two lines, that of the crown a diameter of one and one-half lines, with a length of two and one-half lines, diminishing to a sub-recurved apex"

(Owen, l. c., p. 41). A pair of teeth are also developed near the front of the upper jaw. With these mandibular and dental characters seem also to be coördinated a less developed dorsal fin, comparatively longer temporal fossæ, the deep fissure limiting the front part of the supraorbital ridge; the more deflected jugals, and the more rounded lateral ridges of the hinder portions of the maxillaries. As it is certain that a generic name will sooner or later be desired for the form so distinguished, it may be called on account of the symmetrically rounded lower jaw *Calligнathus*. The known species are as follows:

1. KOGIA BREVICEPS Gray ex Blainv. Habitat, Cape of Good Hope.
2. KOGIA GRAYI Gray ex Wall. Habitat, Australia, near Sydney.
3. KOGIA MACLEAYI Gray ex Krefft. Habitat, Australia, near Sydney.
4. KOGIA FLOWERI Gill. The form is robust; the dorsal very low, "posterior to which is a sharp ridge as if belonging to the fin, extending towards the tail;" the color black or blackish above, whitish or yellowish-white below, and upwards and forwards, including the end of the snout.

The lower jaw at its symphysis below is very compressed, has concave sides, and its greatest depth is at about the posterior third of the symphysis; the dentigerous area extends backwards nearly to the anterior point of the deltoid sinus of the inner wall of the dental canal, and is much incurved: behind the area, the margin is nearly straight and horizontal.

The teeth are very long and slender, very much curved outwards and backwards, and acutely pointed; there are about fourteen or fifteen in number on each side.

The animal on whose jaw and portrait the species has been based, was obtained a short distance from Mazatlan, in 1868, and measured nine feet in length; its blubber yielded seventy-five pounds of oil. No details as to its mode of capture were sent by Colonel Grayson, but it was remarked that "it is said to be a strange fish in those waters."

5. CALLIGNATHUS SIMUS. Habitat, India, coast of Vigigapataw, Madras Presidency.

9. *On the Nomenclature of Kogia.* A few words concerning the nomenclature of the genus seem to be demanded.

Dr. J. E. Gray, perceiving certain discrepancies between the figure and descriptive notice by Blainville of a skull from the Cape of Good Hope, referred by the latter author to the genus *Physeter*, and named *P. breviceps*, conferred

upon it in 1846 the barbarous generic name *Kogia*, with the following diagnosis:

"Head moderate, broad, triangular. Lower jaw wide beneath, slender, united by a short symphysis in front. Jawbone* of the skull broad, triangular, as broad as long."

In 1854, Mr. W. S. Wall,† in a "History and Description of the Skeleton of a New Sperm-whale [etc.]", described in addition a new pygmy species, to which he gave the name *Euphysetes Grayi*, evidently inclining to the opinion that it would prove to be congeneric with *Kogia breviceps*, but on account of the inapplicability of Gray's generic diagnosis, refusing to identify it with that form; he "regretted that a barbarous and unmeaning name like *Kogia* should have been admitted into the nomenclature of so classical a group as the cetacea."

The name *Kogia* has also been repudiated, and *Euphysetes* adopted by Professor Owen, who has acknowledged the generic identity of the species on which they were respectively based; in reference to it, that profound naturalist has remarked that he has "that confidence in the common sense and good judgment of [his] fellow countrymen and labourers in philosophical zoology which leads [him] to anticipate a tacit burial and oblivion of the barbarous and undefined generic names with which the fair edifice begun by Linnæus has been defaced."‡

Dr. Gray, defending his name, has observed that "Mr. MacLeay objects to the barbarous name of *Kogia;*" and the learned doctor of philosophy, with charming naïvete, adds: "I have been asked, what does *Euphysetes* mean? should it

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*Lest this character might be inexplicable, it is proper to state the author meant the rostral portion of the skull.

†The work quoted has been lately attributed to Mr. W. S. MacLeay, but as Mr. Wall has assumed the responsibility of authorship with the evident consent of Mr. MacLeay, there seems to be no good reason for accepting *ex parte* evidence in the case, or even for inquiring into the relations of the parties with regard to the contribution of scientific knowledge and literary skill; in this opinion, I simply concur with Professor Flower.

‡Owen, Mon. Brit. Foss. Cetacea Red Crag, No. 1, 1870, p. 27; (Ray Society).

not have been written *Euphycetes*, with a *c*?" The suggestion of Dr. Gray's questioner can scarcely fail to elicit a smile at the ignorance displayed in the question, or perhaps a laugh at the execrably complicated pun that may have been intended, and which appealed to evidently unappreciative ears. The name is a *literal* rendition of the Greek (*Ευ*, augmentative, and *Φυζητὴς*, blower), and, as explained by the framer, simply means "*a good or easy blower*."

Notwithstanding, however, the objections to the name *Kogia*, we adopt it, as Professor Flower has also done, because of its priority, while we recognize the justness of the criticisms upon it. But if we were to pursue the course recommended in repudiation of it, hosts of generally admitted generic names would have to be superseded, among which would be most of those of the author of the name in question. Linné himself furnished a precedent for the adoption of names other than those derived from the classical languages, although *he* admitted such with cautiousness and a due regard for sense and euphony. Analogous names, proposed though they may be without like reserve, must in the judgment of the great majority of systematists be retained, lasting monuments to the discredit of their authors, and an opprobrium to zoology.

EXPLANATION TO CUTS.

168. Skull of *Callignathus simus*, seen from the side.
169. " " " " " " above.
170. " " " " " " below.
171. " " " " longitudinally bisected.
172. Lower Jaw of *Kogia Floweri*; the dotted lines indicate the approximate form of the hinder portion of the ramus.
173. Skull of adult *Physeter macrocephalus*, seen from the side.
174. " " " " " " " above.
175. " " " " " " " below.
176. " " " " " longitudinally bisected, to show the relative size and the form of the cranial cavity.

bo, basioccipital; *eo*, exoccipital; *so*, supraoccipital; *p*, parietal?; *s*, squamosal; *f*, frontal; *pl*, palatine; *j*, jugal; *sh*, stylohyoid; *bh*, basihyoid; *th*, thyrohyoid.

NOTE.—All the figures of the ten illustrations of Cachalot (*Physeter macrocephalus*) are copied from Professor Flower's monograph "On the Osteology of the Cachalot or Sperm-whale (*Physeter macrocephalus*)," in Trans. Zool. Soc., London, Vol. vi, pp. 309-372, 1868, and those of *Callignathus simus*, from Professor Owen's memoir "On some Indian Cetacea collected by Walter Elliot, Esq.," in Trans. Zool. Soc., London, Vol. vi, pp. 87-116, 1866. The lower jaw of *Kogia Floweri* is from nature.

Fig. 172.

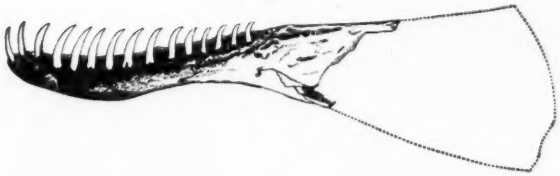


Fig. 169.

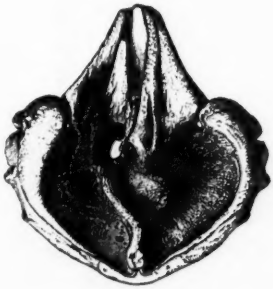


Fig. 171.

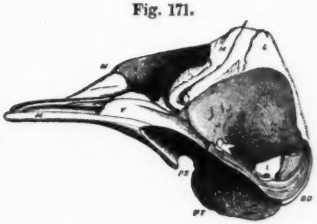


Fig. 170.

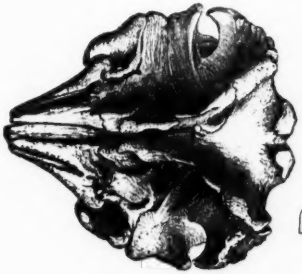


Fig. 168.

Fig. 174.

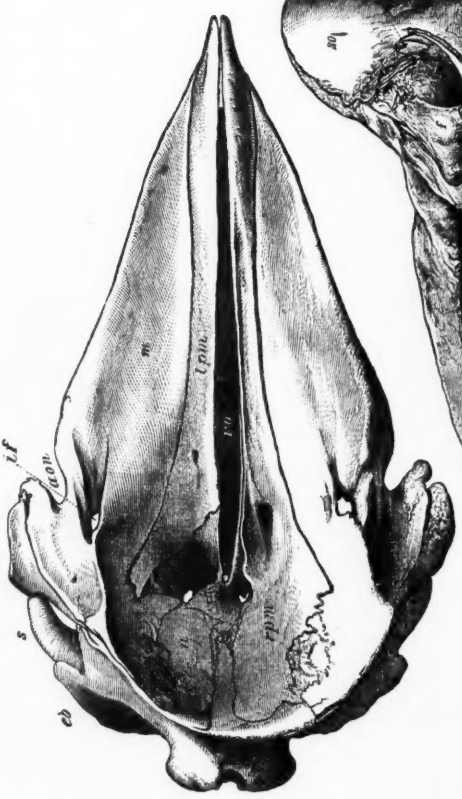
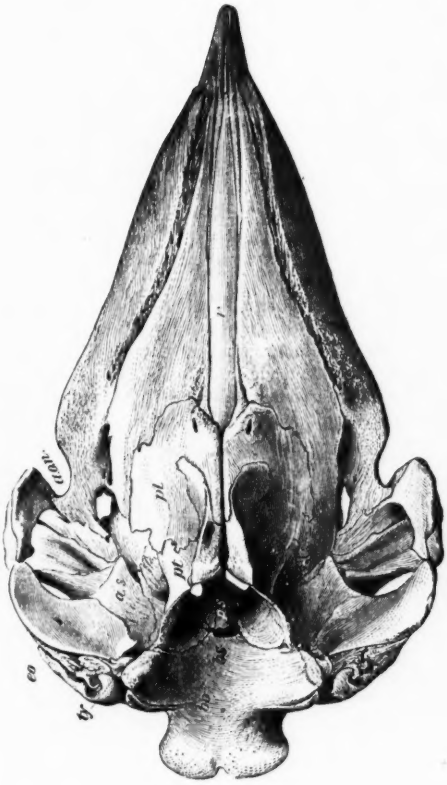


Fig. 173.

Fig. 176.

Fig. 175.



REVIEWS.

DEEP SEA EXPLORATIONS. — In the Report before us * are given the preliminary proceedings and equipment, the narrative of the three cruises performed during 1869, the general results so far as they relate to Physics and Chemistry, and, in an appendix, a summary of the observations upon, and analysis of, samples of sea water and deep sea bottom collected during the cruise. Passing over the first portion for the sake of brevity, (though there is much, especially in the description of the equipment, to interest all naturalists), we learn that the Porcupine, with Mr. Jeffreys and Mr. W. B. Carpenter on board, left Woolwich, May 18th, and after coaling at Galway, on the west coast of Ireland, cruised, dredging at intervals, to the southward and westward. The greatest depth reached was 808 fathoms and an essentially northern fauna was discovered throughout. Among the collections, were *Nucula pumila*, *Verticordia abyssicola*, "*Fusus*" n.sp. like "*F.*" *Sabinii*, *Phakellia ventilabrum*, *Gonoplax rhomboides*, *Ebalia* n.sp., *Ethusa* n.sp., *Geryon tridens* and many small crustaceans. The next dredgings were taken in a line eleven degrees of longitude due west from Galway, and reached a depth of 1230 fathoms. All the mollusca except *Aporrhais Serresianus* were northern (the temperature of the bottom being 37° 8′ Fahr.); several new species and two new genera of the family *Arcidæ* were found, as well as *Trochus minutissimus* Mighels (which has two conspicuous eyes), a species of *Ampelisca*, an eyed crustacean, and numerous gigantic foraminifera. A third trip, from Killebegs to the Rockall Bank was then made, and dredgings as deep as 1476 fathoms succeeded in obtaining an abundance of life. Among the species were an imperforate brachiopod with a septum in the lower valve, which Mr. Jeffreys calls *Atretia gnomon*, *Kelliella abyssicola* Sars, *Cumacea* n.sp., several small new crustaceans; *Pourtalesia*, probably *P. miranda*, A. Ag. and many fine foraminifera, including an *Orbitolites* of the size of a sixpence. The vessel reached Belfast at the end of her cruise on the 13th of July, 1869. The second cruise, under Prof. Wyville Thompson and Mr. Hunter, was undertaken for the purpose of getting a haul of the dredge in 2500 fathoms of water and thus affording a reasonable ground for belief that, if life existed at that depth, it could have no bathymetrical limits. In Lat. 47° 38′ north, and Lon. 12° 08′ W. Gr. a depth of 2435 fathoms was obtained, and a dredge weighing 225 lbs. was sent down with a heavy weight attached to the line five hundred fathoms from the dredge, in order to make it bite the bottom. This apparatus, attached to 3000 fathoms of line, was ten minutes in running out.

* Preliminary Report of the Scientific exploration of the Deep Sea in H. M. Surveying Vessel Porcupine, during the summer of 1869. Conducted by Dr. W. B. Carpenter, V.P.R.S., J. Gwyn Jeffreys, F.R.S., and Prof. Wyville Thompson, LL. D., F.R.S. (Proc. R. Soc. No. 121.)

When hauled in, the dredge contained 150 lbs. of pale gray ooze, containing 23 per cent. of silica, 61 per cent. of carbonate of lime, with some alumina, carbonate of magnesium, and oxide of iron. The animals brought up were, among others, *Dentalium* n.sp. (large), *Pecten fenestratus*, *Dacridium vitreum*, *Scrobicularia nitida*, *Neæra obesa*, *Anonyx Hölbollii* Kroyer, *Ampelisca æquicornis* Bruzel., *Munna* n.sp., several annelids; *Ophiocten Kroyeri* Lütken, *Echinocucumis typica*, Sars; a stalked crinoid allied to *Rhizocrinus;* *Salicornaria*, n.sp., two fragments of a hydroid Zoöphyte; numerous foraminifera, with a branching flexible rhizopod having a chitinous cortex studded with *Globigerina*, enclosing a sarcodic medulla of olive green hue; several small sponges belonging to a new group, etc., etc. Another subsequent haul brought up a *Pleurotoma* n.sp., *Dentalium* n.sp., and *Ophiocantha spinulosa*, besides others previously mentioned. Many of the animals were brilliantly phosphorescent and the eyes in species of all classes were well developed, showing that in these abysses light of some kind must exist. The temperature at the bottom in this case was 36° 5′ Fahr. against 65° 6′ Fahr. at the surface.

The third cruise in charge of Dr. W. B. Carpenter, Prof. Wyville Thompson and Mr. P. Herbert Carpenter, was devoted to the exploration of the *warm* and *cold* areas which had previously been shown to exist between the north of Scotland, the Hebrides, and the Farœ Islands. Space will not admit of even a condensed exhibit of the valuable results obtained on this cruise.

The most important and valuable of the results of these dredgings, due to the great liberality of the British Government, may be succinctly stated as follows.

1. It has been practically proved that there is no limit to the existence of animal life as far as depth is concerned, and that the difference in the specific gravity of the water at the surface and at 2500 fathoms is less than that between salt and fresh water.

2. That there is a constant interchange between the carbonic acid gas from the bottom and the oxygen at the surface, by which the animals at great depths are provided with means of respiration.

3. An abundant supply of dilute protoplasm in the water serves as food for the protozoic inhabitants of the deep sea, upon which latter the higher animals subsist.

4. A glacial *submarine* climate may exist over any area, without reference to the *terrestrial* climate of that area.

5. Cold and warm areas may exist in close juxtaposition, at great depths, and at the same time present quite distinct faunal characters.

6. The bottom, as analyzed by David Forbes, F.R.S., differs essentially in composition from the chalk rock (cretaceous) of England, and no evidence whatever has accumulated to sustain the hypothesis of Dr. Carpenter that the Cretaceous period is at present progressing in the Atlantic sea bed; indeed, that gentleman, in a late letter in "Nature" has practically abandoned this theory.

7. *Temperature* is the great agent which determines the distribution of submarine animals; a view previously maintained by many eminent naturalists and now permanently established by these, and other dredgings in the Atlantic, and by the researches of American naturalists in the North Pacific.

It is to be regretted that the views of Mr. Jeffreys in regard to the specific and generic limits of animals, differ so widely from those of the majority of modern naturalists. In the present report he unites animals belonging to different genera under the same specific name; e. g., *Waldheimia septigera* and *Terebratella septata*, and those who have had occasion to critically examine his British Conchology, find in it many similar cases. Such determinations, of course, will tend to invalidate any conclusions which may be drawn from his report, and will undoubtedly throw a certain amount of confusion upon the whole subject. — W. H. D.

The Classification of Water Birds.* — Although from the title of this paper one might reasonably expect to find the classification of the commonly so-called water birds in general treated of, the writer restricts himself in this able essay to the consideration of the "swimmers proper, as distinguished from aquatic, or even natatorial *Grallæ*." The series of special papers on several of the principal groups of the swimming birds which Dr. Coues has published during the last few years† indicates sufficiently his familiarity with the subject he treats; and the scientific student will find himself warranted in the natural anticipation of finding the essay in question full of important and, in general, well considered data.

Dr. Coues sets out with the assumption that it is demonstrable that the *Natatores* "are one of three primary divisions of birds, at least of carinate birds," which he regards, practically, at least, as subclasses. To prove that the *Natatores* are such a division, and to define the "orders and families" of this subclass, he states to be the object of his paper.‡ After alluding to the fact that a singular unanimity has prevailed in regard to the definition of the group of *Natatores*, and that in the main similar subdivisions have been recognized, though by different authors differently collocated and their rank differently estimated, he proceeds briefly to a consideration of four of the leading modern systems of ornithological classification. These are, to quote his own words, "(1) a

*On the Classification of Water Birds. By Elliott Coues, A. M., M. D., Ph. D., etc. Proc. Phil. Acad. Nat. Sci., 1869, Vol. I, pp. 193-218. December, 1869.

†(1.) Synopsis of the North American forms of *Colymbidæ* and *Podicipidæ*. Proc. Phil. Acad. Nat. Sci., 1862, pp. 226-233, April, 1862. (2.) Revision of the Gulls of North America. Ibid., pp. 291-312, June, 1862. (3.) A Review of the Terns of North America. Ibid., pp. 535-559, Dec. 1862. (4.) A Critical Review of the subfamily Lestridinæ. Ibid., 1863, pp. 121-138, May 1863. (5.) A Critical Review of the family *Procellaridæ*. Ibid., 1864, pp. 72-91, March, 1864; pp. 116-144, April, 1864; 1866, pp. 25-33, March, 1866; pp. 134-197, May, 1866. (6.) The Osteology of Colymbus torquatus; with notes on its Myology, Mem. Bost. Soc. Nat. Hist., I, pp. 131-172, April, 1866. (7.) A Monograph of the Alcidæ. Proc. Phil. Acad. Nat. Sci., January, 1868.

‡In a foot-note (p. 209) he states subsequently that he uses the term "subclass" in a conventional sense only.

dichotomous arrangement in two 'parallel series,' based upon one physiological character, — *Bonaparte*; (2) a trichotomous, founded upon very general considerations, — *Nitzsch*, and after him *Lilljeborg*; (3) quinary, a modification of the second, by dividing two of the three divisions into two each, and with minor changes, — *Vigors*, and many others; (4) another trichotomous, but from a totally different standpoint — recognition of birds as modified reptiles — and carried out with special reference to one anatomical character, afforded by certain cranial bones, — *Huxley*." Each of these systems is reviewed at some length, their general features succinctly presented, and many of their deficiencies pointed out.

In his remarks upon the Bonapartean system, Dr. Coues objects to the comparison of the two groups of birds termed *Altrices* and *Præcoces* to the primary divisions of mammalia, "the *Placentalia* and *Monotremata*"; an objection which appears to be well founded; for in the one case there are important, constant structural differences, whereas in the other no such differences exist. "If helplessness at birth compared with precocity," says Dr. Coues, "means, among birds, 'high' as opposed to 'low' in the scale, then either the reverse is the case with mammals, or else we must compare altricial *Incessores* with Marsupials, and præcocial *Natatores* with the higher orders: a dilemma either horn of which is sufficiently difficult." With the radical differences that exist between the placental and implacental mammalia, and the almost entire homogeneousness of the whole bird type, it is evident that no primary divisions of the latter have yet been discovered that are coördinate with the placental and implacental divisions of the latter. Hence, doubtless, as Dr. Coues partially suggests, birds, in regard to the condition of the young at birth, should be compared with the *Placentalia* alone. The præcocial birds would then be comparable with the præcocial Placentals, (as the *Herbivores*,) and the altricial birds with the altricial or higher Placentals. The vast difference in the modes of generation between birds and mammals, and between the two subclasses of mammals, renders the resemblance, as primary groups, of *Altrices* and *Præcoces* to the Placentals and Marsupials one rather of remote analogy than of homology or true parallelism. So widely different, in fact, are the ornithic and mammalian modes of execution of the vertebrate plan, especially as regards the mode of reproduction, that it is difficult to conceive of the possibility of a division of birds into two groups which would be strictly comparable with the subclasses of mammals. It is nevertheless true that in the two great groups of birds first recognized by Oken — the *Altrices* and *Præcoces* — but afterwards so thoroughly elaborated by Bonaparte that the system, as all will admit, appropriately bears his name, there is something that forcibly recalls the two subclasses of mammals. This division, in the present writer's opinion, trenchantly separates birds into two highly natural, primary series, with, to a great extent, parallel or representative groups in each, and so distinct that no removal of any of the groups of the one series to the other can be made without bringing illy-asso-

ciated groups into juxtaposition, although no constant structural difference has yet been discovered by which to separate them.

The partially natural basis on which the system of Nitzsch is based is clearly recognized by Dr. Coues, although the data on which it was founded have thus far been but very imperfectly presented.

In regard to the quinary system of Vigors, though theoretically wrong in its assumptions, especially as developed by some of Vigors's followers, Dr. Coues justly finds (as the present writer has been long of the opinion there existed) many facts that to a certain extent favor this arrangement in regard to many of its details. The remarkable vitality of the system, and its strong hold upon public opinion, as Dr. Coues observes, is evidence that it has some foundation in nature, in consequence of which it was able for a long period to hold its ground despite the numerous technical objections that have been urged against it, and the invectives and sneers of its opponents, as well as the far more injurious indiscretions of its friends. As Dr. Coues in this connection remarks, it was a great stride onward when the idea of a "lineal" classification was abandoned; and it was doubtless the advantages of the "circulatory" system of grouping, and the recognition of similar modifications of the members of diverse groups that gave to the Vigorean system some of its recognized advantages. Dr. Coues, however, goes further: "A system," he says, "that disposes objects in circumscribed planes is a great advantage over a lineal arrangement, but it stops half-way to the goal. The third dimension is needed; to length and breadth must be added thickness; the circle must become a sphere. . . . . We cannot predicate affinity or analogy only to the right or left, — the top or bottom, — but must take it that all groups, near or remote, may approach, touch, or fuse with each other, along the axis of either of the three possible diameters" (p. 197). The idea here embodied — that of the possibility of the affinities of groups lying not in a single direction only, but in several or in any direction (though not necessarily implying generic relationship) — is one that has doubtless impressed the majority of naturalists, and which has given rise, in the various efforts made for its expression, to the numerous and often fancifully inosculating systems of different authors. The metaphysical form in which Dr. Coues expresses this idea imparts to it, doubtless, to many minds, a somewhat objectionable character.

In reviewing Professor Huxley's classification, Dr. Coues terms it "an attempt" — as a slight examination of it is sufficient to show — "to classify birds with reference to a single set of characters — the modification of certain cranial bones." His criticism of it, though severe, is discriminating and appreciative, and will receive the sanction of probably a large proportion of ornithologists. A summary of his views may thus be given in his own words: "Prof. Huxley has laid ornithologists under two-fold obligations: First, he has pointed out in elaborate detail a certain character, the value of which was not only unknown, but also unsuspected before; and has shown how perfectly it marks groups of a

certain grade. Second, he has demonstrated once more — and it is to be hoped for the last time — the futility of attempting to found such fundamental divisions ["orders," etc.] upon any one single character. . . . As the sole basis for a system of ornithological classification, the scheme will probably remain in critical abeyance only until the time when its brilliancy shall have been forgotten, and its unsoundness alone remembered."

Professor Lilljeborg's system is justly referred to as "the most 'catholic' system that has ever been proposed;" since cognizance is taken by its author of the works of most of those specialists who have investigated certain sets of characters, on which, however, they improperly based systems of classifications. Lilljeborg's system not only meets, in general, the approval of Dr. Coues, as of numerous other ornithologists, but it is essentially followed by him in his classification of the *Natatores*, although he adopts an opposite order of arrangement of the several groups. His scheme is hence almost the same as that of the "Arrangement of Families of Birds" published in 1866 by the Smithsonian Institution,* which was only a slight modification of Professor Lilljeborg's system. Dr. Coues regards the division of the *Natatores* by Lilljeborg into two groups — *Simplicirostres* and *Lamellirostres* — intermediate in rank between the subclass and the orders, as not only a superfluous intercalation, but as an unnatural division, from the inequivalency of the two groups; this discrepancy constituting the chief difference between the systems of Coues and Lilljeborg.

In discussing the relations of the *Natatores* to the *Grallatores*, the character and affinities of two "ambiguous forms" are incidentally adverted to. These are the *Phœnicopteridæ* and the *Haliornithidæ*, the latter of which is regarded as fulicarious in its affinities, and the former as belonging to the grallatorial *Cursores*. Notwithstanding the heron-like form of the Flamingoes, almost their whole structure is so well known to be anserine — with which their prœcocial habits accord — that it is a matter of surprise that Dr. Coues should follow Lilljeborg and others in referring them to the *Cursores;* almost their sole point of divergence from the *Anatidæ* consisting in their elongated grallatorial form, they being in fact merely long-legged ducks.

Dr. Coues's classification of the *Natatores* may be tabulated as follows:

* Smithsonian Miscellaneous Contributions, Vol. viii, p. 8, June, 1866.

Subclass.	Orders.	Families.	Subfamilies.	
Natatores.	I. Pygopodes.	Spheniscidæ (Penguins.)		Altricial.
		Alcidæ.	*Alcinæ* (Auks.) *Phaleridinæ* (Crested Auks.) *Uriinæ* (Guillemots.)	Præcocial.
		Colymbidæ (Loons.)		
		Podicipidæ (Grebes)	*Podilymbinæ* (Grebes.) *Podicipinæ* (Grebes.)	
	II. Longipennes.	Procellariidæ.	*Diomedeinæ* (Albatrosses.) *Procellarinæ* (Petrels.) *Halodrominæ*.	Altricial.
		Laridæ.	*Lestridinæ* (Jaëgers.) *Larinæ* (Gulls.) *Sterninæ* (Terns.) *Rhynchopinæ* (Skimmers.)	
	III. Steganopodes.	Sulidæ (Gannets.) Pelecanidæ (Pelecans.) Phalacrocoracidæ (Cormorants.) Plotidæ (Darters.) Tachypetidæ (Frigate Birds.) Phaethontidæ (Tropic Birds.)		Altricial.
	IV. Lamellirostres.	Anatidæ.	*Anserinæ* (Geese.) *Anatinæ* (River Ducks.) *Fuligulinæ*, *Erismaturinæ* (Sea Ducks.) *Merginæ* (Mergansers.)	Præcocial.

While the above system, as already stated, differs in no very essential points from others previously proposed, but is rather a corroboration of the one before most approved, we find collocated in Dr. Coues's essay many facts not previously brought together. Great value is also given to the paper by the comprehensive and well elaborated diagnoses of the groups which it contains.

As indicated in the foregoing remarks, we are not prepared to accept Dr. Coues's classification in full, notwithstanding the evident thorough-

ness with which he has gone over the ground. To state the reasons which lead us to a different opinion would require far more space than can be devoted to the subject here. We may add, however, that the separation of birds into *Altrices* and *Præcoces*, though based chiefly upon physiological distinctions, is a classification that appears to separate the birds into two natural, primary groups, — a division wholly ignored however by Lilljeborg and rejected by Dr. Coues. In regard to the character which lies at the foundation of this division, the latter author himself admits that "as collateral testimony in the formation of orders and location of families, it has much weight;" and that "certain doubtful cases will probably be decided by reference to it." As he says further, "It draws a sharp, if here and there a broken [?], line between *Gallinæ* and *Columbæ*. It separates, with precision, herons and their allies from other *Grallæ*. *It goes some way in distinguishing lamellirostral from other Natatores;* and other instances of its application might be cited." The exception doubtless referred to in the italicized portion of the above extract occurs in the *Pygopodes*, which is an (artificial?) association of altricial and præcocial types. On this basis the "order" *Pygopodes* would be divided, the altricial *Alcidæ* and *Spheniscidæ* being associated with the *Altrices* as the lowest members of that series, and the *Colymbidæ* and *Podicipidæ* with the *Præcoces*, as its lowest representatives. *Longipennes* would stand first or highest in the altricial series of the *Natatores*, followed by the *Steganopodes* and the altricial *Pygopodes*. The *Lamellirostres* would head the præcocial or lower series, followed by the *Colymbidæ* and *Podicipidæ*.

Finally, a word in regard to one or two other systems. Birds, more than any other class of vertebrates, being fitted to live more or less exclusively in either the air, the water, or on the land, the duties of reproduction alone rendering the latter indispensable to some of them, different modes and degrees of locomotion, with corresponding differentiations of the locomotive organs, are required to adapt them to their several modes of life. But facts go to prove that such modifications have not necessarily a high taxonomic value. Birds of great powers of flight, for example, all have a more or less strongly keeled sternum. The greater the power of flight, the larger not only do we find the wing and its motor muscles, but also the processes for their attachment and support, and hence necessarily in these we get a great development of the sternal crest; and, on the other hand, with diminished powers of flight, the converse of all this, till gradually the wings become functionally abortive, and the sternum a smooth buckler. An exclusively walking or swimming bird (a non-flying bird), with a largely developed sternal crest would be an anomaly in nature; and a flying bird, especially one preëminently strong of wing, without a highly produced sternal crest would be apparently an impossibility. Hence the propriety of founding subclasses principally upon the presence or absence of such a sternal character — as it is well known has been done — seems at least highly questionable. Again,

webbed feet, which usually accompany a swimming or aquatic mode of life have been erroneously accorded a similar importance in classification. Yet the altricial *Natatores*, the *Laridæ* especially, and preëminently the *Lestridinæ*, have the most positive affinities with the *Raptores*, of which they are really the aquatic or natatorial form. However valuable such features may be in determining the limits and relations of families, and of groups next above families, modifications of the locomotive organs can hardly be considered as a proper basis for subclass or even ordinal divisions.—J. A. A.

THORELL'S EUROPEAN SPIDERS.*—The character and extent of this work, which is invaluable to students of spiders even in this country, can not be better stated than in the words of the author (pages 18 and 19):

"I have first made up a systematical list or review of the suborders, families, subfamilies and genera of European spiders recognized by me. Each generic name is accompanied by the name of the author who first published it, and the year when this took place, moreover by its etymological derivation, its synonyms and the name of the species that typifies the genus; and lastly are subjoined such synonymical and critical remarks as I have thought appropriate. In almost all the genera which I have had the opportunity of examining, I have subjoined a short description of the form and armature of the tarsal and palpal *claws*, which organs have not yet attracted all the notice they appear to deserve. Under the head of each family I have introduced a short account of the characteristics of the subfamilies and genera it comprises. These characteristics I have endeavored as far as possible to derive from the number and position of the eyes and the form of the organs of the mouth, partly because such distinctive features are easily verified, partly because they are most generally (often too exclusively) used, at least in determining the limits of the generic groups. But I have also endeavored to make use of the different forms and numbers of the spinners, of differences in the conformation of the cephalothorax and abdomen, in the relative lengths and armature of the legs, the number of claws on the tarsi, etc. Genera which rest exclusively on such characteristics as belong *only to one sex* leaving the other undetermined, I have not adopted, but consider that they ought to be unreservedly rejected. I ought to call especial attention to the circumstance, that exotic forms have not been taken into consideration in the formation of these schematic reviews, which accordingly can be used as a clew in classifying such only as belong to the *European* fauna. The characteristics of the *sub-orders*, as they cannot be expressed in a few words, and indeed may be considered as generally known, I have not thought it necessary to repeat, but refer for them to e. g. Latreille's, Sundevall's, Westring's and Ohlert's works.

In the catalogue of arachnological literature, with which I have opened this treatise, I have included all the works known to me on *now existing* European spiders, of a *descriptive, systematical* and *zoo-geographical* character, with the exception of such writings as belong to the præ-Linnean period, of which only a small number of works, referred to in the following pages, have been admitted."

The catalogue contains the titles of nearly four hundred works, arranged alphabetically, according to their authors.

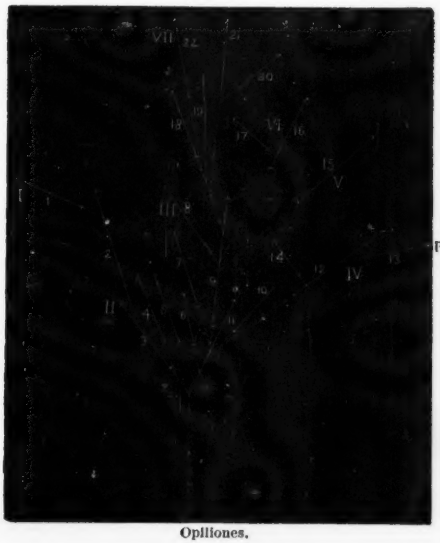
After a discussion of the principles of zoological nomenclature and a statement of those which he has followed, the author proceeds to review the three principal works on European spiders: Westring's "Aranææ Suecicæ," Blackwall's "History of the Spiders of Great Britain and Ireland," and Eugene Simon's "Histoire Naturelle des Araignees," and to compare the spider fauna of Scandinavia with that of Great Britain and Ireland.

In regard to the classification of the spiders, he says:

* On European Spiders. By T. Thorell. Part 1. Upsala, 1869-70. 4to. pp. 242.

"Whether we endeavor to arrange the families and genera of spiders in a continuous series, from that group which is looked upon as the most perfect down to the lowest, or vice-versa, or whether we arrange them according to some other principle, we are soon met by the same difficulties, which present themselves, whenever we endeavor to arrange in such a manner any class or order whatever of the productions of nature. As regards the larger groups of spiders, the suborders and the families, the reasons for the order of arrangement we have chosen will, we hope, easily be seen if one casts one's eye on the accompanying diagram, which gives a view of the connection founded on real *affinity*, which the families of the spiders adopted by us, according to our opinion, have to each other."

Fig. 177.



Opiliones.

I. Orbitelariæ.
1. Epeiroidæ.
II. Retitelariæ.
2. Theridioidæ.
3. Scytodoidæ.
4. Enyoidæ.
III. Tubitelariæ.
5. Urocteoidæ.
6. Omanoidæ.
7. Hersilionidæ.
8. Agalenoidæ.
9. Drassoidæ.
10. Dysderoidæ.
11. Filostatoidæ.
IV. Territelariæ.
12. Theraphosoidæ.
13. Liphistioidæ.
14. Catadysoidæ.
V. Laterigradæ.
15. Thomisoidæ.
VI. Citigradæ.
16. Lycosoidæ.
17. Oxyopoidæ.
VII. Saltigradæ.
18. Myrmecionidæ.
19. Otiothopoidæ.
20. Dinopoidæ.
21. Eresoidæ.
22. Attoidæ.

In a note, the author expresses his belief with Darwin, that "propinquity of descent is the hidden connection which our classifications attempt to find and express.

The work closes with a list of the genera of fossil spiders found in Europe, compared with living genera.—J. H. E.

GEOGRAPHY AND ARCHÆOLOGY OF PERU.* — While in England recently, Mr. Squier was induced by his friends to reprint in pamphlet form the paper which he read before the American Geographical Society in February last. We gave an abstract of that portion of the lecture which related to the Archæology of Peru in the NATURALIST for September; but the present pamphlet contains much interesting and important information relating to the geography of the great Titicaca basin to which we did not allude in our former notice, and will well repay reading by all interested in this great centre of a prehistoric nation.

NATURAL HISTORY MISCELLANY.

ZOOLOGY.

MORPHOLOGY AND ANCESTRY OF THE KING CRABS. — In a communication to the Boston Society of Natural History, Oct. 17, 1870, Dr. A. S. Packard, Jr. stated that a study of the embryology of Limulus, as well as its anatomy, led him to consider, as several authors had done, from Savigny and Van der Hoeven down to the present time, the anterior division of the body as a cephalothorax, the posterior division being the abdomen. Latreille, Milne-Edwards, and more recently Mr. Henry Woodward, † the distinguished palæontologist, have regarded the anterior division of the body as the head, and the posterior division as embracing the thorax and abdomen, the last three segments in Mr. Woodward's opinion, including the telson, representing the abdomen. Against this view he thought could be brought the embryological facts already stated at the meeting of the American Association for the Advancement of Science at Troy. He there stated that the germ first started as a Nauplius and that just previous to moulting a Nauplius-skin in the egg, the abdomen was differentiated from the cephalothorax. In this latter region (composed of six segments) are contained not only the eyes, simple and compound, but all the ambulatory appendages, which surround the mouth and are true maxillipeds, no antennæ or thoracic appendages being developed. This region contains the stomach and a considerable portion of the intestine, and the liver, which opens into the intestine near the middle of the cephalothorax, sending but a single pair of biliary tubes into the abdomen. The anterior half of the dorsal vessel, with two pairs of arteries and two pairs of valvular openings, is situated in the cephalothorax.

* Observations on the Geography and Archæology of Peru. By E. G. Squier, M.A., F.S.A. etc. 8vo. pamph. London. Trubner & Co., 1870. (Price 25 cents. Address Naturalists' Agency.)

† On some Points in the Structure of the Xiphosura. Quarterly Journal of the Geological Society of London for Feb. 1867.

Lastly, the genital openings in both sexes are situated on the first pair of abdominal lamellate appendages, the testes and ovaries lying wholly in the cephalothorax; the ovaries, when distended with eggs, filling up the front of the cephalothoracic shield.

The abdomen consists of nine segments, the long spine-like telson forming the ninth, as seen plainly in the embryo. The abdominal cavity is small, the abdomen being very thin, and mainly filled with the muscles attached to the lamellate feet.

There are, then, in Limulus, no thoracic feet, comparable with those of the Decapods and the Tetradecapods, and the thoracic region (as much of it as exists), is merged with the head, in fact never becoming differentiated from the head proper. Thus we have in Limulus a crustacean with the body divided into two regions; a cephalothorax (the thorax being potential, viewed externally, with no appendages or segments to indicate its existence) and a nine-jointed abdomen.

This disposition of the body-segments is paralleled by the zoëa, or young, of the Decapods. In the freshly hatched zoëa the body is divided into two regions; the cephalothorax, with no trace at first of thoracic segments, or thoracic appendages, (the two pairs of large feet being deciduous maxillipeds), the thorax not being yet differentiated; and a five-to-seven-jointed abdomen. The size of the cephalothorax, as compared with the abdomen, varies greatly in the different forms of zoëæ, some zoëæ strongly resembling Eurypterus in the small cephalothorax. After the first moult five pairs of rudimentary thoracic limbs arise at the hinder portion of the cephalothorax, thus proving our statement that the cephalothorax of Limulus, and consequently the so-called "head" of Eurypterus and Pterygotus, combines a head with a potential thorax, the latter never becoming differentiated in subsequent moults.

In the Trilobites, however, according to the late discovery of Mr. Billings, the thoracic segments bearing jointed feet are developed; though, as shown by Barrande, the larval trilobite is hatched either without any, or with but a single, thoracic segment. Limulus, Eurypterus, Pterygotus, and their allies (Huxley has aptly compared the Eurypteridea to a zoëa), with the Phyllopods, may be considered as virtually zoëæ, or to be more precise, (since they lack many important characters of zoëæ), retarded or retrograde zoëæ.

Speculating on the ancestry of the members of the subclass* of Branchiopoda, he would trace them all to a common Nauplius form, as Haeckel, Fritz Müller, and Dohrn had done. This Nauplius form may have existed in the Laurentian Period, as we already find highly organized Trilobites, Phyllopods, and Ostracodes in the lowest Silurian strata. He

*Though in his communication to the American Association he has spoken of the Branchiopoda as an *order*, of which he regarded the Pœciloptera as a suborder, he thought the term *subclass* preferable, as, with the subclasses Decapoda and Tetradecapoda, etc., they were much more general groups than the orders of Vertebrates as first limited by Linnæus, whose idea of an order we should follow for the sake of uniformity, just as the term *family* should be applied in the sense in which Latreille used it.

suggested that the modern Phyllopods, such as Apus and Branchipus, may have descended perhaps, by two parallel lines of descent from certain Silurian Copepoda and Ostracoda. He accounted for the origin of these forms rather by a process of acceleration and retardation of development as suggested by Messrs. Cope* and Hyatt,† involving a more or less sudden formation of generic forms, than by the theory of Natural Selection, which involves an indefinite number of slight modifications for the production of even a variety, and such a succession of intermediate generic forms as we do not find recent or fossil. He also thought that the study of the facts of Dimorphism and Parthenogenesis, and the mode of production of the more remarkable sexual differences among animals, would throw light on a comprehensive theory of evolution.

THE ANCESTRY OF INSECTS. — Referring to his discovery of Pauropus in this country, and mentioning the six-legged form of the young, and its resemblance to Podura, and comparing it with the Hexapodous young of Julus and the young of certain mites, Dr. Packard, at the same meeting, referred the ancestry of the Myriapods, Arachnids, and Hexapodous Insects to a Leptus-like terrestrial animal, bearing a vague resemblance to the Nauplius form among Crustacea, inasmuch as the body is not differentiated into a head, thorax or abdomen, and there are three pairs of temporary appendages. Like Nauplius, which was first supposed to be an adult Entomostracan, the larval form of Trombidium, had been described as a genus of mites under the name of Leptus (also Ocypete and Astoma) and was supposed to be adult.

For this primitive, ancestral form he proposed the term Leptus. He suggested that the ancient Leptus may have descended through Demodex from some Tardigrades, and that this latter group had perhaps descended through some form like Linguatula, from a true terrestial worm, like the remarkable Peripatus, for example. The Myriapods may, through a parallel line of descent, have been evolved from some Leptiform animal like the young of Pauropus, while the Hexapoda may have descended by a parallel line of descent through some Leptiform Silurian insect resembling the young of Stylops, Meloe, and low neuropterous or orthopterous larvæ, and the Thysanura, such as Podura and Lipura. He did not regard the insects as having been evolved either from a zoëa or Nauplius form, but would refer the ancestry of both classes (the Insects and Crustacea), independently of each other, to the worms (Annulata).

MONTEREY IN THE DRY SEASON. — On returning to the coast from the Colorado valley in May, 1861, my health impaired by the tropical heat of the last two months at Fort Mojave, and by the too sudden change to the foggy climate of the coast, I was glad of the opportunity of recruiting it by some weeks devoted to collecting marine animals, etc., at Monterey.

* Origin of Genera. Philadelphia. 1868.

† Parallelism between the order and individual in the Tetrabranchiate Cephalopods. Memoirs of the Boston Society of Natural History, 1866, and AMERICAN NATURALIST, Vol. 4, pp. 230 and 419.

Leaving, therefore, my military companions at San Diego, I travelled to San Francisco by land, picking up about forty species of Mollusca at points along the southern coast.

My preparations for dredging, determining my collections, and describing the new vertebrates detained me in San Francisco until August 9th, when I went to Monterey by steamer. There I remained until September 26th, dredging, and collecting along shore chiefly Mollusca, but not neglecting other animals. The additional species collected were thirty-two of Vertebrata, one hundred and seventy-five Mollusca (thirty new species) twenty-seven Radiata and twenty-six Articulata (marine, as I kept no account of the land species constantly preserved). As I have written a very full report of the Mollusca collected, for the American Journal of Conchology, and as most of the other invertebrates have never been determined, because they were lost in the ill-fated steamer "Golden Gate," together with a large collection from the southward, made previous to June, 1862, I can give little that is new or interesting relating to my Monterey collections. The season was the worst for collecting birds, they being in moult; mammals were difficult to obtain and the fishes were chiefly those common in the San Francisco market. Though many whales were killed during my visit, chiefly the "California Gray" (*Rachianectes glaucus* Cope), it was impossible to obtain measurements and drawings of them as they were always cut up while floating, and the mutilated carcasses when washed ashore were deprived of "flukes" and other essential parts, besides smelling so strong that the odor for miles was almost unbearable.

The land mammalia were chiefly very distinct from those of Fort Mojave, as is naturally to be expected in comparing a well-wooded, fertile region with an almost barren desert. The Grizzly Bear was quite common, though I saw only its tracks. Several others of the large forest quadrupeds, well known as Californian, are doubtless to be obtained by longer and more thorough search than I could make. I got two small rodents, the representatives of species to be found at Fort Mojave, viz: the California Wood-rat (*Neotoma fuscipes*), and Wood-mouse (*Hesperomys Californicus*), also one of a genus not found there, the Monterey Field-mouse (*Arvicola edax*).

The most characteristic land birds were the Vulture (*Cathartes Californianus*), the Pigmy Nuthatch (*Sitta pygmæa*), western variety of the Yellow-bellied Fly-catcher (*Empidonax flaviventris* var. *difficilis*), Least Titmouse (*Psaltriparus minimus*), Yellow-billed Magpie (*Pica Nuttallii*), Western Crow (*Corvus caurinus*), White-tailed Hawk (*Elanus leucurus*) besides many representatives of species found in the Colorado valley, such as the Quail (*L. Californicus*), Bowbill Thrush (*H. redivivus*), Anna Humming-bird (*Althis Anna*), Heermann's Song Sparrow (*M. Heermanni*), Californian and Brown Finches (*Pipilo megalonyx* and *fuscus*), while a few seen there only in winter or spring were here breeding, viz: the Black Pewee (*Sayornis nigricans*) Dwarf Thrush (*Turdus nanus*), West-

ern Bluebird (*Sialia Mexicana*), Barn and Cliff Swallows (*Hirundo horreorum* and *lunifrons*), Bewick's Wren (*Thriothorus Bewickii*), Parkmann's Wren (*Troglodytes Parkmanni*), Oregon Snow-bird (*Junco Oregonus*), Chippy (*Spizella socialis*), while a longer residence would no doubt largely increase all these lists. I must however remark that all these, except the second, fifth, and twenty-first, are also summer residents as far south as San Diego, and the three exceptions are probably so in the high mountains east of there. This shows the remarkable uniformity of the fauna, corresponding to that of climate, in zones running parallel to this coast for distances of over five hundred miles.

Of water-birds I observed a few of interest. The whale fishery attracted several species usually seen only far off shore, of which the enormous Petrel or "Gong" (*Ossifraga gigantea*), could often be seen swimming lazily near the try-works to pick up scraps of blubber, sometimes accompanied by the dusky young of the Short-tailed Albatross (*Diomedea brachyura*). The Pacific Fulmars (*F. pacificus*), called by the whalers "Tager" or "Haglet," were common off shore, feeding also on whale meat, but oftener observed chasing the Gulls to make them disgorge. The Murres (*Lomvia Californica*), and Sea Doves (*Brachyzaurphus marmoratus?*), in the open bay seemed strange at this season, but probably both breed near by. On Sept. 10th, I observed many young Phalaropas (*P. hyperboreus?*) about the brackish lagoons near the beach, and a few of the Wandering Tatler (*Heteroseclus brevipes*), as usual among rocks along shore. On the 12th, saw small Grebes (*Podiceps Californicus*), probably lately come from their breeding station; and by the 18th, families of about five each, became common. On the 25th, I first noticed the large Grebe (*P. occidentalis*), but as I left next day I saw no more of the arrival of winter visitors. I need not here particularize the common Sandpipers, Gulls, Terns, Plovers, etc., as I did not preserve any of them, and will have more to say about them when describing my winter collections made at San Diego.

Reptiles are not common at Monterey, on account of the coolness of the summer climate, fogs obscuring the sun for at least half the summer. I found but two species, the large Ridge-back Lizard (*Gerrhonotus multicarinatus*), and a *Plestiodon*, both common in woods from here northward. Batrachia however are well suited by the damp climate, as besides Frogs (*Rana* sp. and *Hyla regilla*), and Toads (*Bufo halophila?*), I found a Salamander (*Batrachoseps attenuatus*) even at this extreme of the dry season, not uncommon.

I will not specify the thirty species of fishes obtained, as most of them have no peculiar English names and the list would be of little interest to general readers. — J. G. Cooper.

The Rough-billed Pelican on Lake Huron. — On the evening of the 15th of June, 1870, a most remarkable specimen of the rough-billed pelican (*Pelecanus erythrorhynchus* Gmelin) was shot by Captain Oliver Maisonville in the marsh at Sarnia, Lambton County, Ontario (Canada).

This bird is very rare on the great lakes, and the individual in question, which was of the male sex, was of unusually large size. It weighed thirty-three pounds, and the expanded wings measured in full one hundred and eight inches! The bill from the eye was sixteen inches in length, being of a dirty yellow or yellowish brown. The plumage was almost pure white, with the exception of the alula, primary coverts, and primaries, which were black, as usual. The long feathers on the breast and those of the crest were of a very pale yellow tint. I also noticed, what I have seen no mention of in the description of this species, that over each eye was a group of small feathers of a brownish black color, and of more than an inch in length, almost simulating an eyebrow; a few feathers of a similar or lighter hue being scattered towards the back of the head. The plumage exhibited nothing of the roseate tinge which this species is described as having at the season of reproduction.

In Baird, Cassin, and Lawrence's "Birds of North America," this pelican is mentioned as breeding "in the fur countries, generally selecting inaccessible places in the neighborhood of water falls;" and as being found "throughout the United States, rare on the coasts of the Northern and Middle States;" and as also inhabiting "throughout the Rocky Mountains and California." The same work gives the stretch of wings as seventy inches, and length of bill 13.50, while much smaller specimens are recorded. Mr. James Hobson, who mounted our specimen, and who is of much experience in this direction, having received several of this species from Florida and elsewhere, says he never before saw so large a pelican; all others he had seen being insignificant in comparison. During a residence of over twenty years in the region of the great lakes, I had not previously met with the pelican, nor had I heard of more than three instances of its having been captured within their limits.

The marsh at Sarnia is an inlet or overflow of the river St. Clair, near its head, and about one mile from the south shore of Lake Huron. The pelican was feeding in the marsh, and had been there two days, having arrived on the evening of the 13th of June. When first seen it was flying from the northward, from the direction of the lake. On the morning of the 14th it flew back to Lake Huron, but returned in the evening of the same day, remaining till shot on the following evening, as before stated. It was very active, wandering over the marsh all day, swimming about, or only rising for a short flight, and alighting again in the water. Strange to say there were no fish found in its pouch; only a few small worms and insects. — HENRY GILLMAN, *Detroit, Michigan.*

MIGRATION OF HAWKS. — Do hawks migrate in pairs only, or do they migrate in flocks and separate into pairs as they arrive at their breeding places? In 1856 my attention was called to quite a number of hawks that were diving, and screaming, and going through various gyrations high in the air (as they commonly do in the spring when pairing) and passing to the north-east. Not making any note of the occurrence I cannot give the exact number or date. It was early in the spring, and there must have

been twenty or more. Early in April, 1860, I witnessed a similar migration when the number in sight at one time was about fifty. A friend of mine in an adjoining town, who is a very careful and accurate observer, asked me a short time since if I ever saw a flock of hawks? He said that early this spring (1870), about the last of March or the first of April when passing over his farm with his two sons, his attention was attracted by the screaming of hawks, and on looking up the air seemed to be filled with them. They attempted to count them, but found it somewhat difficult to be perfectly accurate, as the birds were constantly in motion, diving and screaming and passing northward, yet they counted seventy-three in sight at one time. In both of the flights which I witnessed, and also in that seen by Mr. S. and his sons, the hawks were not in flocks according to the common acceptation of the word flock, but were in pairs, or groups of about four usually, all passing in the same direction, northward. Having never read in our works on natural history, of such numbers passing at one time, I give these facts, hoping to call the attention of our ornithologists to them, and draw out from them any observations which they have made on the subject. — Wm. Wood, M. D., *East Windsor Hill, Connecticut.*

Scudder's Work on New England Butterflies. — Illness in my family has thus far prevented my completing the work on New England Butterflies announced some time since in these columns. This delay has, however, enabled me to extend the original plan of the book much more fully than was anticipated.

I gladly take this opportunity of thanking my many friends and correspondents for the cordiality with which they have seconded my undertaking, in furnishing me with innumerable notes upon the times of appearance and prevalence of different butterflies in their respective localities. When it is known that such memoranda have already been received from ninety different persons, covering a period of observation of from one to ten years, and, in the case of some butterflies, including as many as one hundred and fifty or two hundred notes for a single species, it is not too much to say that we shall arrive at a degree of exactitude upon the history, seasons, and geographical distribution of our butterflies, which we have not hitherto enjoyed.

In the hope of gaining still further knowledge on these points, I should be pleased to receive notes made by any observers during the season of 1870; descriptions of habits, modes of flight and of posture would be most welcome; and since the result of inquiries has proved the necessity of incorporating in a work on the butterflies of New England and vicinity many forms not mentioned in previous lists of New England species, I beg all persons interested to send me the fullest possible notes, as well as examples of the early stages of the following species (most of these have seldom or never been known to occur in New England; where the names are italicized, specimens of the imago are desired for examination): Papilio Marcellus, *Pieris Virginiensis*, *P. vernalis*, Callidryas Eubule,

Colias Labradorensis, *C. Keewaydin*, C. Eurytheme, Terias Lisa, Xanthidium Nicippe, Anthocaris Genutia, *Nymphidium dorsale*, Lycæna violacea, L. Pembina, L. Scudderii, *Thecla Ontario*, *T. Clothilde*, *Euptoieta Claudia*, *Melitæa Batesii*, *Apatura Clyton*, *Grapta Dryas*, G. Fabricii, G. interrogationis, *Libythea Bachmanii*, *Satyrus areolatus*, Chionobas Jutta, Nisoniades Lucilius, *N. Horatius*, *N. Virgilius*, N. Martialis, N. Icelus, *Eudamus Bathyllus* (not Pylades) *E. Olynthus*, Hesperia Oileus, H. Wingina, H. vialis, H. Monoco, H. Hianna, *H. Mesapano*, H. Delaware, H. Phylæus, *H. Wyandot*, and *H. Huron*.

Persons possessing from their collections and memoranda any precise data, however meagre, for determining the respective times of appearance of the different species of Grapta and Nisoniades, as recently distinguished in the Transactions of the American Entomological Society and the Proceedings of the Boston Society of Natural History, will confer a special favor, by communicating them; many of those already received have lost much of their value from the confusion of the species. Due credit will be given in every instance.

Letters, memoranda and specimens, sent to my address at the *Society of Natural History, Berkeley Street, Boston*, before March 4th, 1871, will be forwarded thence to me in season for incorporation in my book. The manuscript will soon be completed. It will form an imperial octavo of from four to five hundred pages, and be illustrated by chromolithographic plates in a style which, judging from specimens prepared, has never yet been equalled, even in Europe. — Samuel H. Scudder.

Callidryas Eubule Linn. — This large Pierian butterfly was taken by me at New Bedford, Mass., Aug., 31st. Mr. Sanborn, who has seen the specimen, speaks of it as the first one of the kind observed in New England, or at least in Massachusetts. H. W. Parker.

[Mr. S. I. Smith informs us that he has taken this insect abundantly at Fire Island, Long Island, N. Y., during the past summer.] — Eds.

Mephitis bicolor. — Since my note in the August Naturalist was written, on the occurrence of this species in Iowa, I have obtained another skin in Grinnell, Iowa, and still another in Des Moines, from a dealer in pelts, who informs me that he bought at least fifty skins of the kind last winter, procured in that vicinity. There is reason to believe that the species may be found even in central New York. Dr. S. J. Parker, of Ithaca, N. Y., has twice seen by the roadside, in that region, a small, many-striped skunk, very different from the common one.—H. W. Parker.

Woodcock and Moles. — The Shrew Mole (*Scalops Canadensis*) has been somewhat abundant for a few years past in Essex county, Massachusetts. These animals are found in low moist lands, though not unfrequently in highly cultivated gardens. The shrew mole is seldom seen above ground, but burrows with celerity below its surface.

The Star-nosed Mole frequents the same moist places, where, like the

shrew mole, it finds its favorite food, such as earth-worms, grubs, etc. In procuring its food it makes extensive and numerous burrows, above which mounds of loose dirt are thrown to the surface of the land, which destroy the smooth and even surface of the meadow and make it look unsightly and difficult to cultivate.

Now there is a beautiful bird designed by nature to prevent the increase of these noxious animals from becoming excessive in places frequented by the mole. It is the woodcock (*Scolopax minor*), whose death is delayed until the 15th of August by a law of the State, after which time there will probably be a general attack made upon them with the gun.

It is observable what a difference there is in the appearance, in some localities, occupied by the above mentioned animals. A friend told me a few days since that it was difficult to mow a piece of his land last year on account of the many piles of earth thrown up by the moles. This year the surface of his land is smooth, and I have passed several times this summer by the place and have frequently heard, or flushed the woodcock feeding there in the dusk of evening. — AUGUSTUS FOWLER, *Danvers, August* 14, 1870.

TURKEY BUZZARD. — On page 375, current volume, J. L. B., in a paragraph on this bird, inquires "Can a Turkey Buzzard be deceived by his sense of smell? Did the Buzzard mistake the skunks' smell for putrefaction?" Two propositions are here answered as undeniable. First, that the Turkey Buzzard selects its food by the sense of smell; and second, that it prefers putrefied food. It seems to me that the exhaustive experiments by Mr. Audubon and Dr. Bachman, made nearly forty years since, as related by the former in his "Ornithological Biography," Vol. ii, page 33, should settle these questions. I think, then, that it may be safely assumed that both the Turkey Buzzard (*Cathartes aura*) and the Black Vulture (*Cathartes Jova*) are practically incapable of distinguishing odors, and select their food by the sense of sight alone; and also that they feed upon fresh, as readily as upon putrid, flesh. As the old error on this subject seems to be perpetuated no doubt to a considerable extent, and as that great work is rare, at least in private libraries, might not the whole, or at least a part of the paper to which I have referred, prove interesting to your readers? — J. D. CATON, *Ottawa, Illinois, Aug.* 22, 1870.

SPIKE HORNED BUCKS. — Mr. H. H. Bromley, proprietor of the Chasm House near Keeseville, has given me an account of the *spike horns* that is confirmatory of "Adirondack's" statements, and also shows that the variety extends farther south in the Adirondack region than heretofore stated.

Mr. Bromley was for six years the landlord of the Hotel at Franklin Falls, located on the Saranac River, about thirty miles southeast of Lewis Lake and the region mentioned by "Adirondack." When he first went into this region, eight years ago, he was told about the spike horned bucks which were then *common* and well known to all the hunters and trappers in the Saranac region. During his residence at Franklin Falls,

he shot several spike horns, and one at least was a large buck of *four years* if not of five, and was so considered by several old hunters. In this specimen one of the horns was slightly forked at the end, but the other was a simple slightly curved spike. Mr. Bromley says that any old hunter of the Saranac region would laugh at the idea of all the spike horns being young bucks of two or three years, and he states that they can be recognized by their *shorter legs*, as well as by their spike horns.

Mr. Bromley thinks that the spike horns have increased in numbers over the branched horns, and that in spite of the extensive hunting are about as abundant as when he first went into the woods. — F. W. P.

Deer's Horns. — It is a well known fact that the horns of deer are but very seldom found in the woods, even in districts where the deer are very plenty. Several ways of accounting for their disappearance have been suggested, but the cause that seems to be the best substantiated is that of their being eaten by the various species of rodents seeking their food under the snow in early spring. In confirmation of this theory Mr. H. H. Bromley of Keeseville, N. Y., has informed me that he once found a deer's horn in the woods that had been partly gnawed, and had been nearly eaten through in two places by mice. — F. W. P.

Singular Manners and Customs of the Hornbills during the Breeding Season. — No sooner has the hen commenced the labor of incubation, say several trustworthy observers on this subject, than the male walls up the hole in the hollow tree in which the hen is sitting on her eggs, until there is only room for the point of her bill to protrude, so that until her young birds are hatched she remains confined to her nest, and is in the meantime assiduously fed by her mate, who devotes himself entirely to this object. This habit has been testified to not only by Tickell, Layard, and other Indian naturalists concerning some of the Asiatic species, but is also spoken of by Dr. Livingstone in the case of hornbills met with during his African explorations, and there appears to be no doubt of its authenticity. In Sumatra, in 1862, Mr. Wallace heard the same story from his hunters, and was taken to see a nest of the concave-casqued hornbill, in which, after the male bird had been shot while in the act of feeding its mate, the female was discovered walled up. "With great difficulty," Mr. Wallace tells us, "I persuaded some natives to climb up the tree, and bring me the bird. This they did, alive, and along with it a young one, apparently not many days old, and a most remarkable object. It was about the size of a half-grown duckling, but so flabby and semi-transparent as to resemble a bladder of jelly, furnished with head, legs, and rudimentary wings, but with not a sign of a feather, except a few lines of points indicating where they would come." — *Nature.*

GEOLOGY.

The Megatherium and its Allies. — The law of adherence to type, or pattern, in the skeletons of the Megatherium, Megalonyx and Mylodon, extinct animals of the sloth tribe, appears to be illustrated in a remarkable manner in the following particulars: —

First. — In the great size, weight and solid condition of the bones of the extremities and in their want of medullary cavities.

Second. — In the number, arrangement, $\frac{5}{4}\text{-}\frac{5}{4}$, mode and unlimited growth of their teeth; in their deep insertion into the jaws; their deeply excavated base; in the structure of their teeth, when viewed as organs, — made up of a cylinder of vascular dentine, dentine and cementum, and more particularly in the striking resemblance of their organization when examined under the microscope; that of the Megatherium and Mylodon being precisely the same, with the exception of the looped canals or tubules in the cementum, as figured by Prof. Owen in the article Odontography, in the "Encyclopædia Britannica."

Third. — The bones of the skull resemble each other strongly in the great development of the cells of the diploë, which in their general appearance resemble wood eaten through and through by the largest sized worms; and in the shortness of the face. The alveoli of the two jaws correspond in number, position and relative depth, with the exception of Megalonyx, which has its first molar in the upper and lower jaw separated from the other teeth and taking the usual place of the canine or cuspidate teeth.

Fourth. — The bones of the chest and trunk have, in general, a strong resemblance in size and form, especially the ribs in size, the scapula in form, the expanded ilia, and the clavicles. The bones of the hand and arm have a marked family likeness — the radius and ulna of Megathere and Megalonyx, the humerus of Megalonyx and Mylodon in particular, and in all the genera in the broad expansion of the external and internal condyles of the humerus for the origin of the supinator and pronator muscles. The differences between these in outline and form from that of Megatherium will be hereafter alluded to.

Fifth. — The number and size of the bones in the tail of Megatherium and Mylodon, and the use to which this appendage is put, appear to be precisely the same, making with the posterior extremities a most stable tripod for the support of these animals while reaching for their food.

Sixth. — In the broad and massive femur of the Megatherium and Megalonyx there is a marked resemblance: as figured in Leidy's "Memoir" and in the "Penny Cyclopedia" and "Encyclopædia Britannica," this bone in the Mylodon appears not to be so flattened in front, but this appearance may be only the result of foreshortening in the drawing; judging from a fragment in my possession it does not differ much from the femur in Megathere or Megalonyx. The tibia of Megalonyx bears considerable resemblance in form to that of Mylodon, but it is not united in either of these animals (making as it were one bone) as in Megatherium.

The bones of these extinct animals differ somewhat: —

First. — In the general outline of the lower jaw of Megatherium, especially that of Meg. Cuvieri from South America; less so, however, in that part where the teeth are implanted in the N. American Megathere, and in its anterior prolongation.

Second. — The skulls of Megalonyx and Mylodon, looking at them either from above or below, differ somewhat, especially in their width;

this difference, however, may be the result simply of the displacement forwards of the first molar, as appears to be the case with some varieties of dogs.

Third. — The humerus of the Megatherium differs from that of Megalonyx and Mylodon chiefly in that part from which the *brachialis anticus* muscle arises. The bone in Megathere at this point, viz., on either side of the insertion of the deltoid, being broad and flat, while, in Megalonyx and Mylodon especially it forms, with a marked prominence on the outside of the bone, a large hollow surface looking outward and backward, for the origin of the external part of the muscle, and which large and deep groove seems to have been filled up by it. The distal extremity of the humerus of Megalonyx is pierced by a large but short oval canal for the passage of the median nerve and brachial artery, which canal is not to be seen in the humerus of the Megatherium or Mylodon, although there is in the humerus of the latter a groove near this spot along which, in all probability the nerve and artery passed in their course to the forearm.

Fourth. — The astragalus of the Megalonyx, Dr. Leidy says "bears much more resemblance to that of the recent, than to any of the extinct sloths. That of the Megatherium is the most characteristic bone in the skeleton: the upper surface being so hollowed on one side, as to throw the whole weight of the leg upon the inner side of the foot."

Fifth. — The cubitus of Mylodon, as figured by Dr. Harlan, very slightly resembles either that of Megathere or Megalonyx.

From the few facts above stated, it would be unwise to draw hasty conclusions, and if the three genera have a common parentage it would be difficult to say to which genus the first pair belonged. Are there not, however, as strongly marked resemblances between the skeletons of the different members of this extinct tribe of animals as are to be found in Hipparion, Anchitherium and Equus, which have been brought forward by Professor Huxley in confirmation of Mr. Darwin's hypothesis?

The marked resemblance between the skeletons of the Megatherium and Mylodon as set up in the Museum of the Royal College of Surgeons, London, and in the Museum of the Boston Society of Natural History, must be acknowledged by all who have seen the skeletons, or the figures of them under the articles Unanu, "Penny Cyclopedia," Palæontology, "Encyclopædia Britannica," and the beautiful photograph by Mr. Allen of Boston.

No less marked will appear the mechanism of the elbow joint in all the genera of these digging animals, and the upper or mashing surface of their teeth, so characteristic of all the Megatheroid tribe — the surface presenting at one time "a transverse sulcate plane, at another, excavated in the midst, with prominent margins." — H. C. Perkins, M.D.

The Tertiary Beds of the Amazon. — Up to December, 1867, no fossils had been observed in the peculiar variegated clay formation which overspreads the great valley of the Amazon. At that time I was sojourning with my friend Hauxwell at Pebas, where I discovered a multitude of

fossil shells exposed in the fine section made by the Ambiyacu just before it reaches the Marañon. These shells were examined by Gabb, who showed that they existed in brackish water of Tertiary date; but he made the mistake of identifying the Neritina as *N. pupa*, which is now living. Conrad shows it is an extinct species. I then engaged Mr. Hauxwell to explore for other localities, being sure they would be found. He soon reported a similar deposit thirty miles below Pebas on the south side of the Marañon, about one hundred and twenty miles west of Tabatinga, where he found the very same species occurring at Pebas, and many more, and larger kinds. Out of half a bushel of specimens which he sent me, this is the result arrived at by our eminent palæontologist, Mr. Conrad. Not one species was found in the whole collection which is now living; indicating an early tertiary date. There were seventeen distinct species, *all extinct*, belonging to genera only three of which are now represented. The most numerous species seems to be the *Anisothyris* (*Pachydon*) *obliquus*. In the whole collection there is but one land shell (Bulimus), and but one decidedly fresh-water species (Hemisinus). The great majority belong to a genus which was especially abundant in the early Tertiary, and lived in brackish water. This agrees perfectly with my theory of the origin of the Amazon Valley; at first a Mediterranean sea separated from the Caribbean and South Atlantic by the rise of the water-sheds which created the Orinoco and Paraguay, it was gradually freshened by the influx of the fresh-water streams from the surrounding highlands, and gradually emptied into the Atlantic by the continued rise of the Andes. The fossils were found in the heart of the valley interstratified with the colored laminated clays which I had traced from Curary on the Rio Napo down to the Lower Amazon, and which Agassiz affirms is a glacial deposit brought down from the Andes and worked over by a vast glacier moving over the whole plain. This is mere assertion, for he found not one positive evidence. Besides, there are strong biological and physical arguments against the theory of tropical glaciers. My fossils are wonderfully perfect, even the most minute and delicate ones, and none show the least abrasion; a glacier would have ground them to powder. Conrad says they must have lived and died in the vicinity of the spot where they now occur so abundantly.—James Orton, *Nov.* 15, 1870.

Lead Mines of Missouri. — Mr. G. C. Broadhead read a paper before the St. Louis Academy of Science in October, entitled "Notes on the Geology of Cole County, Missouri." He mentions that the Magnesian limestone series, which include the rich mineral deposits of Missouri, occur in Cole County, and that the rich Galena lead mines are in the lower beds of the second Magnesian limestone. At Fowler's mines he noticed lead, zinc, and heavy spar; the latter in very clear amber-colored crystals and in blue lamellar forms.

Marks of Ancient Glaciers on the Pacific Coast. — Dr. Robert Brown dissents from the theory of an entire absence of glacial remains proper on the Pacific slope of the Rocky Mountains, stating that the

northern drift is present in Vancouver Island and British Columbia, "in as marked a manner as ever I saw it in countries celebrated for the presence of such remains."

He finds rounded hills, trap bosses, rounded rocks, and grooves, while the whole country is strewn with erratic boulders. Great masses, sixty to one hundred tons in weight, are found scattered everywhere over the island (Vancouver) from north to south, and through the region lying on the western slope of the Cascade Mountains. "Grooving and other unequivocal marks of *general* ice action are not wanting in Washington Territory either. The drift marks extend northward to the Queen Charlotte Islands, near the boundary line of Alaska. — *American Journal of Science.*

Boulders in Ancient Times. — In a communication made to the Academy of Sciences of Vienna, M. Boué remarked on the accumulations of boulders in secondary deposits and in the sandstones and conglomerates of the tertiary period. These accumulations have been explained either by the mining force of the currents of water, or by subterranean displacements, or by aqueous eruptions. The most ancient of these blocks are found in the older carboniferous sandstone. They have been traced between Jurassic and Cretaceous beds, and in the latter; but nowhere do they more frequently occur than in the Eocene and Miocene beds of the Alpes. These last have been very probably transported by glaciers, though he could not admit, as some geologists have, that the glaciers have hollowed out the basins of the lakes, or had existed in the course of almost all geological periods. — *Cosmos.*

New Discovery respecting Coccoliths. — Dr. Gümbel, of Munich, has recently, in a letter to *Nature*, No. 26, for April 28th, established the existence of coccoliths and coccospheres, almost identical in structure with those detected by Professor Huxley, in recent deep-sea dredgings from the bed of the Atlantic, in the Trenton limestone and in a yellow limestone of the Potsdam series, much lower down than they have hitherto been discovered. He finds that the organic remains of these minute animals are left as a residuum after the matrix in which they occur has been heated with highly-diluted acetic or hydrochloric acid.

NOTES.

The Yale College scientific party, in charge of Professor O. C. Marsh, which left New Haven in June last for the Rocky Mountains, returned to this city on the 18th of December. The party, which was essentially a private one, consisted of Professor Marsh and twelve companions, all students or recent graduates of the College. The main object of the ex-

pedition was to investigate the extinct vertebrate fauna of the Tertiary and Cretaceous deposits of the Rocky Mountain country, and the general plan adopted was to make several separate trips, of one or two hundred miles north or south of the Pacific railroad, to regions that were unexplored, or had never been carefully examined.

The first of these was made early in July, from Fort McPherson in Nebraska to explore the Pliocene deposits along the Loup Fork river. Here rich collections of fossil vertebrates were obtained, and several new species of extinct mammals and birds discovered. The next expedition was made in August, from Fort D. A. Russell in Wyoming, to examine the geology of the country between the north and south branches of the Platte river. On this trip the Mauvaises Terres or "Bad land" formation, with the true *Titanotherium* and *Oredon* beds was discovered in Colorado, and traced northward through Nebraska to the North Platte. The fossil remains obtained were also important, and included several species of extinct mammals and birds, new to science.

The third expedition was made from Fort Bridger, Wyoming, in September and October, to examine the geology of the Eastern Uintah Mountains, and the country between the Green and White rivers. In this region interesting geological discoveries were made, and many new Tertiary vertebrate remains secured, which will soon be described by Professor Marsh. On their return, the party went to California, and spent a month in visiting various points of scientific interest; after which they came east to Denver, and thence to Fort Wallace, Kansas. About two weeks were spent in exploring the Cretaceous beds of this vicinity, where some interesting reptilian and fish remains were obtained, and the party then returned to the east.

The expedition as a whole was very successful, and the large collections made will be placed in the Peabody Museum of Yale College. The more important scientific results will soon be published.

Capt. Wheeler, who explored in Nevada last year, has an expedition probably started or about to start. Mr. H. A. Green, late of the Illinois Geological Survey, is Geologist and Mineralogist. Ferdinand Bischoff, who was an indefatigable member of the Scientific Corps of the Western Union Telegraph Expedition, is to make the zoological collections. Capt. Wheeler is to ascend the Colorado Cañon from below with a steamer. His party will have abundant facilities for transportation, and the Commander is much interested in the scientific part of the work. Mr. Powell got an appropriation of $12,000 to make a second descent of the Cañon of the Colorado, and will do so some time this winter. He has already been on to that part of the country, and arranged his details. Altogether the Cañon is in a fair way of being thoroughly explored.

The French *Académie des Sciences* has held its sittings regularly since the beginning of the siege, and the *Comptes rendus* has been published regularly every week. — *Nature.*

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